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BRIEFLY TOLD.

MUNICIPAL LIGHTING IN MASSACHUSETTS.—During the last session of the Legislature of Massachusetts the politicians who depend largely upon their ability to give tongue to the well-worn war cry of "progress," as a means of keeping themselves before the public, seized with avidity upon the project of committing the gas and electric lighting service of large and small localities to the custody of the local authorities. Here they claimed was a certain and lasting way of releasing the taxpayer and his satellite, the tenant, from the clutches of at least one grinding monopoly. For years capitalists interested in gas undertakings had been growing rich at the expense of those who were users of gas light, and later on came another set of capitalists who, interested in the sale of electric currents, were fast waxing financially corpulent at the expense of those who thought their lighting needs were best served by arc or incandescent lamps. Cities and towns themselves were the largest customers of these lighting companies, and, argued the "wind-jamming" politicians, why not reserve and distribute this profit amongst the people, who could, by maintaining their own lighting plants, secure light at first cost. The dreamers who hold that a paternal government that shall take charge of all industry is the acme of civilization, joined in the cry, and between them a bill was hatched out, the provisions of which were about as dishonest to capital already invested in artificial lighting undertakings as they could well be. Under the terms of the measure local authorities were empowered to build and operate gas and electric light works in direct opposition to similar works carried on by local corporations—public and private lighting to be regarded as fair prey by the municipal authorities. When the bill was brought to the notice of the General Assembly, representatives whose course as legislators impelled them to pay due regard to honesty, and whose determinations were reached through a desire to do justice to all, and not deafened by the shrill clamor of unreasoning bellowers, amended it so as to cause it to conform to justice and equity. As the bill as signed by the Governor has already appeared in our columns, we need only say now that the perfected measure secures owners of existing lighting plants the right to sell the same to the authorities, at a price to be agreed upon by fair means—which is in direct conflict with the desires of the original proposers, whose simple plan was to bankrupt such owners. Now that they can engage in the luxury of operating gas and electric lighting plants, the desire for such embarkation does not appear to be as pronounced as it was some "moons" ago. Several committees have been appointed by various towns to look into the advisability of taking up the plan, and one locality has already cast the first ballot (it resulted in the affirmative) for such a course, but it seems in the main that the committees of investigation are disinclined to recommend their superiors to go on with the task of municipal lighting, a disinclination that appears to become all the more pronounced as their study of the questions involved becomes prolonged. As a matter of fact the agitation for the taking over of local lighting plants in Massachusetts appears to be the strongest in localities where the lighting companies now in operation are far from enjoying a state of solid financial strength, a fact which would seem to indicate that the owners of companies are willing to give up the struggle against ill-favored fortune. In the larger cities no report is had of the willingness of the authorities to go into the lighting business, which is proof of the fact that they are satisfied to leave this industry in the hands of those who have directed it for years, in profitable seasons and in years of loss. Further, the authorities are satisfied that should the light suppliers act outside the bounds of reason, they can be brought up with a round turn to answer for their misdeeds before the State Board of Gas and Electric Light Commissioners, a body whose intelligent supervision of the interests committed to their care must challenge the admiration of all conservative men, be the latter engaged in the supply of artificial light or not.

THE JOURNAL IS APPRECIATED.—Some days ago we received the following letter, which explains itself: "Please find enclosed $3, for the AMERICAN GAS LIGHT JOURNAL, which I would like to have sent to the above address. During my four years' service on the Massachusetts Gas and Electric Light Commission I always enjoyed reading it, and I think its contents will give me quite as much satisfaction now that I am a free citizen again.—Yours Truly, A. B. COFFIN."

NOTES.—Manager Ramsdell, of the American Gas Company, is to be congratulated on the clever way in which he managed the negotiations that resulted in the securing of the public lighting contract at Rockford, Ills., which Company is a branch of the American Gas Company. The proposition was given in full in our issue for July 6th.——Mr. Charles F. Woodward, President, and Messrs. Ezra M. Southworth and

B. P. Buzzell, Directors of the Citizens Gas Light Company, of Wakefield, Mass., having sold out their interest in the Company, have resigned.——The reduced gas rate at South Bend, Ind., has resulted in the placing of a great number of gas stoves.——During the G. A. R. encampment at Detroit one of the most imposing of the decorations in the city was that on the front of the Detroit Gas Light Company's handsome office structure. It consisted of a flaming G. A. R. badge, 36 feet in height, made of gas pipe. Three service pipes supplied the gas, and the gas consumed each hour while the device was illuminated amounted to 13,000 cubic feet.

[Communicated Article.]

Gas Companies, Gas Associations, and the World's Fair.

When the first propositions were made that the various gas associations should take an active part in placing, at the Chicago World's Fair, an exhibit, devoted solely to the gas industry, that would prove of interest to the visitors and be advantageous to those engaged in supplying the market, the idea found much favor. Committees were appointed and money was voted to defray the necessary preliminary expenses, and considerable time was devoted to the subject at the regular and committee meetings of the aforesaid associations. But although the members of these committees were zealous and earnest in their endeavors to accomplish the end apparently desired—as indicated by the votes of their respective bodies—the results seemed to be *nil*. Considering the feeling bordering on enthusiasm with which the subject was at first taken up, the apparent apathy of the members of the associations, following the loyal efforts of their committees, would seem to be inexplicable. However, there seems to be some reason for all this, which perhaps it might have been well to have considered earlier. But, again, perhaps the true state of affairs could not be discovered without having done exactly what was done. It was soon found that even the preliminary work would require the expenditure of considerable sums of money, and as the associations are entirely dependent upon the stated contributions of their individual members, in the shape of annual dues and admission fees, and as these were kept as low as possible, with reference to the actual necessary running expenses, but little money could be set aside for other purposes. The associations provide lecture and committee rooms, print and distribute papers, and some go so far as to publish their proceedings in book form. All this is most valuable matter for gas companies and their officers, but the money collected in the shape of annual dues is all expended. As a rule, the members are obliged to provide the means without assistance from the gas companies, who are the real beneficiaries of the associations in this respect. Here was a self-evident reason why the associations could not go much further in the World's Fair programme. It was proposed to appeal to the gas companies for aid, but that plan did not meet with much favor; and, in fact, why should it? The directors of the companies would probably feel that they had no right to vote away any portion of their stockholders' money to aid in setting up an exhibition of gas apparatus anywhere, except perhaps in their own home town, and for obvious reasons. It was asserted that the exhibit of electrical apparatus at Chicago would be wonderful, and that gas should take an equally prominent position. On the other hand, it should be remembered that the said exhibition of electrical appliances will be made by, and at the expense of, people interested in selling electrical apparatus and not by companies engaged in merely vending electricity for the various purposes to which that force is now applied. At any rate I have not heard of any such company going into the exhibition business, although enjoying an extensive acquaintance among electric lighting companies.

There is no doubt but what our energetic friends of the "Kindred Industries"—the retort, meter, fittings, gas engine, stove makers, pipe founders, and others not enumerated—will not "be left" at the Chicago World's Fair, and that we may confidently look forward to a creditable showing of gas appliances when the time comes for it. The officers of gas companies will in all probability all go to Chicago as visitors to the great exhibition, and will most likely come away not only pleased with what they have seen, but will have absorbed many new ideas as to methods of making gas useful. It is hardly to be expected that new methods of manufacture of the article could be given space—nor would it be desirable—upon such an occasion as a World's Fair. Our tried and true friends, mentioned generally above, will take care of the interesting portion of the gas exhibit, which will be there without a doubt. They cannot afford to stay away, as it is in their interest to exhibit; and we know that they are not only as a rule a genial lot of people, but also that they are not known to neglect their business or their interest. The latter they would surely do if they did not exhibit to the best of their means and ability at the coming exhibition at Chicago. Hence we may rest assured that the gas industry will be represented, in the only way that it can and ought to be, even if the associations as such are unable to give the matter any other assistance than that of their presence—which really *all* ought to figure on.

It would give us all great pleasure indeed if gas companies could be induced to take concerted, united action in *anything*. In the past many matters were put before them by our associations that seemed to have the merit of being good subjects whereon to join forces, but the apathy with which the companies regarded the propositions would appear to point the moral clearly that that which depends upon the joint aid of the companies for success or completion rests upon a very weak staff.

A New Form of Gas Burner, Specially Adapted for Gas Testing Purposes.

[Read by Mr. G. R. Hislop before the North British Association of Gas Managers.]

Gentlemen—It is just three years since I had the privilege and pleasure of laying before the members of this Association my views upon a new departure in the construction of union gas burners, and proved to them, by a tabulated set of experiments, the importance of the principles I then propounded—viz., that the angle of impingement of two jets of illuminating gas has a most important bearing upon the character of combustion and intensity of light emitted by such gas. I pointed out also the insuperable difficulties experienced in procuring test burners having their orifices drilled at certain angles. To day I purpose following up this subject a little further, and showing you how I propose to overcome the difficulties referred to. It is just possible I owe an apology for again introducing this subject; but the importunity of your President must be charged with the infliction, should it prove one. I may state that the instrument which forms the subject of this paper was designed by me in connection with my former paper; but the time then at my disposal did not permit of its production. I am, however, not without hope that its production now will meet with some measure of appreciation from the members of the Association. This instrument I have designated "The Angleometer Union Gas Burner." The practical application of it I shall endeavor to explain to you.

In my former paper I pointed out that, in order to carry out my experiments upon the various qualities of gas, I was compelled to have a considerable series of burners specially made to suit various qualities of gas ranging from about 18 to 32½ candles, and having their orifices drilled at different angles off the vertical line. All this is now, however, admirably accomplished in this one burner; supplying as it does a most effective and speedy means of producing the angle of impingement under which any quality of gas will emit the highest intensity of light consistent with, or in conformity to, the existing statutory regulations contained in the various Acts of Parliament. To find the angle, therefore, at which any quality of gas ought to be tested, it is only necessary to alter the inclination by means of a screw adjustment; and this may be accomplished by two methods. The adjusting mechanism necessarily secures constant contact of the burner tips, as also the orifices at a fixed distance; and this secured, it is necessary only to increase or reduce the angle of inclination to produce a flame having the exact extent of elongation, and so as to be just under smoking point.

The importance of securing such a uniform condition while testing all qualities of gas, will be at once apparent—a point which, in the tabulated experiments, I proved to you affects the luminosity of the gas to the extent of from 0.11 to 0.18 candle for each degree on the series of tests made. Taking, for example, a gas of 22.25-candle power, I showed you that, at the angle of 22° off the vertical line, or a total angular distance from each other of 44°, gave the highest result obtainable; the dimensions of the flame being $2\frac{7}{8}$ inches broad by $3\frac{5}{8}$ inches high, while with the same gas tested with the impinging jets placed at an angle of 45° off the vertical line, or a total angular distance from each other of 90°, producing a flame of $3\frac{1}{8}$ inches broad by $2\frac{5}{8}$ inches high, the lighting power was reduced to 19.71 candles—being a loss of 2.54 candles, or 11.42 per cent., or 0.11 of a candle per degree over the whole series of tests made on the gas of this quality. Similarly, gas of 23.8-candle power was found to lose, between the angles of 24° and 45°, 2.53 candles, or equal to 10.63 per cent. On a gas of 26.29-candle power, and tested between 28° and 45°, the loss was 2.51 candles, or equal to 9.55 per cent. Again, with 28.4-candle gas, tested between 33° (as the most effective angle) and 50°, the loss was 2.4 candles, or equal to 8.46 per cent. Gas of 30.28-candle power, tested between 38° and 50°, showed a loss of 2.16 candles, or 7.14 per cent.; and, finally, 32.6-candle gas, tested between 45° (as the most effective angle) and 55°, gave a loss of 1.8 candles, or equal to 5.6 per cent. It will thus be seen that the loss and liability to error are greater in the case of the lower qualities of gas; but this is as may be expected, since with the latter there is much greater liability to over-oxidation. Again, burners are generally made with their orifices drilled at angles much too high for the lower qualities of gas. The risks of error and loss are consequently much greater in testing the latter.

Having now so far explained to you in words the difference due to angular distance, I proceed to give some ocular proof of the force of my statements. The instrument before me is set to the angle of 47° off the vertical; and you will observe that the horizontal dimension or breadth of the flame is much more than the vertical height. Presuming the quality of Edinburgh gas to be actually 27 candles, the illuminating

ower of 5 cubic feet will be, as I am now consuming it, say 24 candles. But if I now alter the angle of inclination of the jets to 28°, as being the most effective angle for that quality of gas, the illuminating power would be raised to 27 candles; the difference representing a gain of 12.5 per cent. The alteration of the angle, you will readily observe, produces a very marked change, not only upon the dimensions of the flame, but upon the amount of light emitted from it. It will thus be seen that the "Angleometer Burner" embraces the entire range of angles under which my former experiments were conducted, or are ever likely to be required in testing illuminating gas. The practical result of the elongation of the gas flame is the combustson of the gas under conditions equivalent to a reduction of 2-10ths of an inch pressure at the point of combustion, while the pressure of 5-10ths is maintained in the jet. This burner therefore offers great advantages to all gas examiners and managers in testing any quality of gas; and since every quality has its appropriate angle, the instrument is speedily adjusted to that angle at which it will eliminate the highest amount of light compatible with, and in due conformity to, existing Acts of Parliament regulating gas supply.

But some may be inclined to ask the question whether, after all, the burner answers the description of a union gas burner as defined by the Board of Trade. I answer, "Most certainly; it is truly a union jet, but with adjustable angles." Angles in relation to quality have hitherto never been thought of, and consequently never defined; and thus the matter of angular inclination of the jets to each other has been left entirely to the mercy of will or accident, as the case may be, only the burner shall have two holes (which constitutes a union jet), just as a human being has two eyes, but with the result not less varied than the visual power of the human eye itself. Such Acts of Parliament should consequently in the future contain a qualifying clause to the effect that the standard 5 cubic feet of gas per hour "shall be tested by a union jet capable of relative angular adjustment, in order to obtain the perfect combustion of the gas."

After what I have stated, it will be readily conceived as possible to construct a scale of flame dimensions which shall approximately indicate the illuminating power of 5 cubic feet of any quality of gas; and this I hope to accomplish.

It is almost unnecessary that I should dwell longer upon the principles I have enunciated in this and in my former paper. Much has been said and written upon the question of gas burners for general use, and many attempts have been made to introduce reform. But however much has already been done, burner makers are not easily enticed out of old beaten paths. I find, for instance, that many difficulties are said to be in the way of making burners of the various angles required, although I fail to see why it should be so; and I am not without hope that these principles will be carried out in practice.

My special business to day, however, is to provide the gas manufacturer and analyst with the best means of determining the illuminating power of all qualities of gas, and that under exactly uniform conditions, considered in relation to the composition of the gas. I have already shown you that the range of error or loss in testing gas—say, of the quality supplied to this city—amounts to 3 candles. But assuming that only one-half of this loss is sustained by defective angular impingements of the gas jets, we have 1.5 candles loss, which I confidently affirm is not overstated. With gas as now supplied here at the rate of 4s. 6d. per 1,000 cubic feet—but taking the actual cost to the corporation at 3s. 6d. per 1,000 cubic feet—for 25½-candle gas, as now tested by the best means available, we have the rate per candle of 1.55d. exactly on the average, but in reality something like 2d., as the cost per candle within the range of error indicated, owing to the higher class of coal required for its production. Now, 1.5 candles at 2d. per candle equals 3d. per 1,000 cubic feet, which, on the quantity of gas sold in Edinburgh and Leith during the past year—viz., 1,239,973,000 cubic feet—amounts to £15,499 13s. 3d.

It is unnecessary to point out that such loss does not apply to this district alone, but to all corporations and gas companies supplying similar gas (the one I represent not excepted). But where lower qualities are supplied, the loss may be much greater. This loss, however, it will be borne in mind, falls in the first instance upon the gas manufacturer, and not upon the consumer, as presently considered. My purpose now is chiefly to show the means by which the gas manufacturer is justly entitled to take credit for supplying the gas consumers a much better article than he has hitherto had credit for, and at the same time conforming to the conditions of proof as to quality contained in the Act of Parliament or otherwise. No doubt the effect would be to increase the difference of loss as between the results so obtained and those realized in ordinary domestic and factory lighting; but I have the satisfaction of having, in my former communications, propounded a remedy, to some extent at least, for such loss in their case also, which might be carried out if only "time" to me and "the will" were present with the burner manufacturers. In the meantime, I content myself with having directed your attention to certain important and hitherto overlooked conditions, which I have endeavored to prove are all-important to you and to me in their financial and economical aspects.

While the instrument which has been the subject of this paper is specially applicable only to gas testing purposes, I propose to make it at the same time applicable for ordinary use, as, whatever rights we may claim for ourselves as gas manufacturers, the claims of the gas consumers must ever receive our special consideration. As I stand before you to-day, I have fresh upon my memory the first paper I read in the interest of gas consumers, to the members of this Association, and in this city, 23 years ago, when I enunciated my views upon what may be regarded as amongst the first attempts at the so called modern system of regenerative gas lamps—viz., that of covering the tops of all gas shades, and furnishing them with a controllable ventilating device, so as to consume the gas in a heated atmosphere—a system which was recently made the subject of a patent by a Glasgow gentleman.

And now, while thanking you for your attention, I have only to say I shall be glad to further explain to any who may desire it the principles and working of the "Angleometer Burner."

Discussion.

The President said the members had now heard the paper, and followed out the details of the illustrations, and he hoped they would discuss the points of the communication.

Mr. D. Bruce Peebles (Edinburgh) said that everything Mr. Hislop brought before them always showed a great deal of honest and hearty work. He had gone into this question very ardently, and in the paper he had read that day had shown clearly that he had attacked a subject of very great importance to gas producers and consumers. He thought, however, that in the instrument exhibited, he saw a little bit of a grandchild of his own. Many years ago he produced an appliance wherein two gas burners were automatically arranged so that they left one another and then coalesced. Some years afterwards he read a paper to the Association, and exhibited before them an arrangement in which two burners were brought together so as to show the increased illuminating power by this operation. This could be arranged at certain angles; and he must say that Mr. Hislop had followed this up, and produced a very beautiful instrument, which would very much more clearly give the different angles required. The difficulty he (Mr. Peebles) found in connection with burners was to know what the various angles should be for different qualities of gas. This was a point which had been very clearly brought out. He could remember the type of flame that Mr. Hislop had just shown. It was known all over the world before Mr. Bray brought out his burner. Mr. Bray produced a flame of more brilliancy, but of less illuminating power. Mr. Hislop's paper was so interesting, that it should lead to a great deal of discussion. There was no doubt the ideas put forth had been brought out before in London; and they might be taken up now in connection with Mr. Hislop's method of increasing the illuminating power of gas. He (Mr. Peebles) remembered very clearly Mr. Hislop's former paper, and that he gave them a very good illustration of the necessity, in burning gas, of allowing the proper quantity of oxygen to go through to secure perfect combustion. There was another point which was brought before them long ago by Mr. Hislop in connection with this matter—what was called the Methven Screen. Mr. Hislop long ago employed a similar method, where the hole, instead of being rectangular, was simply circular. Mr. Fiddes, of Bristol, deserved the credit of having introduced that system.

Mr. A. Smith (Aberdeen) asked if the same quantity of gas was being consumed in the first flame shown as in the second. He thought Mr. Hislop had stated that the pressure was 5-10ths in the first flame, and reduced to 3-10ths in the second. The former appeared to him to be a little "*wiredrawn*;" and the latter he did not think would be a pleasant one to the eye. If, however, they could get anything to raise the quality of the gas 3 candles, it would be a great thing indeed.

Mr. R. Mitchell (Edinburgh) said that Mr. Hislop had very kindly referred to the quality of the Edinburgh gas. Perhaps it had not been his fortune to have to experiment with the same quality of gas, and therefore his burner did not altogether suit the Edinburgh gas. They strove at all times to give 27 candle illuminating power; but in the West they only supplied 18, 19 and 20 candle—nothing more. He thought if Mr. Hislop had had a little more experience with the Edinburgh quality of gas, he might have had a more efficient burner to suit it. They were, however, very much indebted to him for bringing the subject before them, for he had been very successful with his arrangement. It was

one of those things which might, in due time, come to be of service to the general public.

Mr. A. MacPherson (Kirkcaldy) thought that the members all acknowledged that they were indebted to Mr. Hislop for his present paper, and also for one he read on a former occasion. He (Mr. MacPherson) considered that in the last paper Mr. Hislop had very clearly demonstrated to the Association the great benefit to be gained by having burners pierced at various angles for different qualities of gas. This, he thought, Mr. Hislop had carried a step forward; and although at that time he was unable to illustrate what he had found to be the case, he showed it to them that day, and he (Mr. MacPherson) considered he had clearly made out his case. He thought they had only to look at the second flame, and compare it with the first, to see the difference between the two. He was of opinion that the illuminating power of the second flame was much superior to the one they saw before the altering of the angle. He thought Mr. Mitchell must have misunderstood Mr. Hislop's description of the burners, because it clerly pointed out that with a richer gas the loss was not the same as with a poor gas, and the benefit was the greater the poorer the gas. He (Mr. MacPherson) also considered that Mr. Smith had not comprehended Mr. Hislop. As he understood the paper, there was the same pressure and the same quality of gas in both cases; but Mr. Hislop would be able to enlighten them on the matter. He thought they could see for themselves, with the naked eye, that the illumination afforded by the same quantity of gas arranged at one angle was superior to what it was when burning at another angle. Mr. Hislop deserved their thanks for the manner in which he had investigated the question of gas burners; and nothing would tend more to give satisfaction to the consumers than a proper set of burners constructed on the principle advocated, suitable for all qualities of gas, from 18 up to 27 candles. A good idea was that the consumers should be supplied by the gas companies with burners specially adapted for the gas manufactured by them. In this way, not only would a benefit be conferred on the companies, but the advantage would be extended to their customers. If they were able to make 25-candle gas appear to be of 27-candle power, so much the better for the companies; and if they could develop a candle or two more for the same consumption, so much the greater saving for them. His opinion was that they should do all in their power to encourage Mr. Hilsop.

Mr. Peebles asked Mr. Hislop if he had tried the effect upon the burners of very low pressure at these great angles. Would the low pressure not bring a corresponding type of flame, even although the angle of the burner was much greater than was illustrated at present?

Mr. J. West (Manchester), while acknowledging that the subject of burners was a very important one, said he did not set out to argue the point raised as to the angles, because it was one on which he had not experimented. He had, however, made a large number of tests with burners; and he thought there was a great deal in the question about low pressure. He made experiments a few years ago on every burner he could procure, and he read papers in Manchester on the burners actually in use in the city as compared with modern kinds. He found that, with the burners the consumers were using, the gas had an illuminating value about 30 per cent. less than it was capable of giving. He sent men out to collect burners in the city, and then compared them with the modern types. He gave the members this explanation to show them that the question before them was an important one. The conclusion he arrived at was that every burner should be governed. This was a question which gas manufacturers should take up, so as to show the people what burners they should have. They could do more in this way in pushing out the electric light than in any other. They should advise people to purchase the best burners; and if they did not follow this advice, let them have the burners for nothing.

Mr. Vass (Portobello) asked a question regarding the relation between the angle and the illuminating power of the burners. He said they had at present some testing appliances, but they were all very expensive. What was wanted was an instrument suitable for small works; and he thought the one before them might be utilized in that way.

Mr. W. Key (Tradeston, Glasgow) said the arrangement shown struck him as very well adapted for the purpose for which it was designed. The way Mr. Hislop directed the nozzles on to each other was one which must seem to them all to be very simple and effective. As to Mr. Vass's suggestion, he was afraid such a thing could not be. One thing had been mentioned by Mr. West, which was, he thought, at the root of the whole matter of the angles, and that was the velocity with which the gas approached the point of combustion, by having a tube wide enough instead of the old narrow burners. As an illustration, he mentioned Bray's "Special," where the tube was very wide, and they had a very slow, sluggish flame. This was what Mr. Hislop wanted, so as to have the best development of light they could get at the time. He considered Mr. Hislop had succeeded most admirably, and deserved their thanks for the admirable instrument he had designed.

Mr. J. Ballantyne (Rothesay) expressed the opinion that what was really wanted was a burner which consumers could regulate for themselves. He would like to know, however, if Mr. Hislop would give them some idea as to the cost of the burner. The drawback with consumers was that the cheaper the burner, the more demand there was for it; and if it was costly, the consumer would not have it. If Mr. Hislop's burner was cheap, they could induce consumers to purchase it.

Mr. W. Edwards (Renton) asked if an attachment could not be made to the burners, so as to regulate the flame; it seemed to be very unsteady and trying to the eyes. This was the reason for so many students and others using reading lamps.

Mr. Hislop, in reply, said he was very pleased his paper had elicited so much discussion. Mr. Peebles's experiment was one to indicate the difference between the original rat-tail burner and the union burner. The first form of burner made was only a jet just as straight as a pencil. A departure was made from this and a burner was invented called the "union jet," which made two jets into one at certain angles. At the same time, he (Mr. Hislop) thought it was a long way from showing how the angles could be altered so as to produce a flame of different dimensions. Mr. Peebles asked a question about tests with low pressures to get the same result. He (Mr. Hislop) believed it would be so. Then as to the question put by Mr. Smith, of Aberdeen, as to the same quantity of gas being burned under the same pressure, he explained that it was so. He might tell the members that the burner (tested before he left Paisley) was rated for $\frac{9}{10}$ pressure. He did not know the quality of Edinburgh gas, and had only assumed it was 27-candle power. It might have been very much higher than he had indicated. As to the cost of the burner, he was not at that moment prepared to say what it would be; because this was the first instrument that had been made, and it had been constructed very hurriedly. When it was ready for sending out, it would be supplied at the least possible cost.

The President said the thanks of the meeting were due to Mr. Hislop for the excellent paper he had brought before them. As Mr. Peebles had remarked, Mr. Hislop never submitted anything to the Association but what was of great use; and he was sure they all agreed with him that the present paper was of considerable service. It must have caused Mr. Hislop great trouble; and they could not do less than accord him a hearty vote of thanks for the admirable paper he had read.

Mr. Hislop, in response, said he wished to acknowledge his indebtedness to Messrs. James Milne & Sons for the assistance he had obtained from them in preparing the instrument.

The Refining of Petroleum and Lubricating Oils.

Petroleum and lubricating oils obtained by the distillation of mineral oil are generally refined by treatment with sulphuric acid and caustic soda, followed by washing with water. Sulphuric acid at 66° B. is mostly employed, the amount used ranging from 2 to 4 per cent. for petroleum to 5 to 10 per cent. for lubricating oils. The acid is well agitated with the oil, either all at once or preferably in several installments, the acid being allowed to settle thoroughly after each treatment. The acid combines with and dissolves the olefines and aromatic hydrocarbons contained in the oil, and an oxidizing action also appears to take place, indicated by the evolution of sulphurous acid. This latter action increases with the specific gravity and temperature of the oil, so that it is well to keep the mixture cool. The time of treatment varies from one to two hours, the operation being finished when a sample of the oil shaken with caustic soda solution appears milky and white or only slightly yellow (petroleum), or when the original green-brown color has changed to violet red (lubricating oil). The loss during acidification is 1 to 3 per cent. for petroleum and 8 to 15 per cent. (seldom 20 per cent.) for lubricating oil.

The oil is next washed with water and well agitated with a caustic soda solution at 30°–33° B. The intermediate washing is best omitted in the case of lubricating oils, since it leads very often to the formation of emulsions, which are separated from the oil with great difficulty. The treatment with soda is continued for 5 to 10 minutes at the ordinary temperature in the case of petroleum, while with lubricating oil the action is carried on at 40°–60° C. until the violet color of the oil is changed to a wine-yellow tint. The consumption of soda lye at 33° B. is about 1 to 1.5 per cent. Too long a treatment with soda must be carefully avoided in order to prevent the extensive oxidation of the oil and the consequent production of the sodium salts of organic acids.

The salts are partially saponified during washing, the acid liberated

being dissolved by the oil and leading to turpidity in the finished product. The oil, after being separated as completely as possible from the lye, is washed with cold water (for petroleum), or with water at 60°–70° C. (for lubricating oil), until perfectly neutral. Thorough washing is of the greatest importance. Petroleum containing sodium salts in solution burns badly, owing to the incrustation that soon forms on the wick, besides which sulphurous acid is given off if sulphates, etc., be present. The water should be as free from dissolved salts as possible, especially for washing lubricating oils.

After washing, petroleum is left in reservoirs for 12 to 36 hours, so that the last traces of water may settle. Or, after standing for an hour, it may be filtered through a mixture of wood shavings and salt. In either case the oil will be ready for the market. Lubricating oil is kept in a vessel heated by steam until the bulk of the water has settled. It is then transferred to a shallow double-bottomed pan and "boiled" by steam until it is quite bright and clear, and no longer froths. In many cases the oil is, after boiling, filtered through animal charcoal, etc.

The apparatus in which the oils are chemically treated may be divided into two groups: 1. Those in which some mechanical stirring apparatus is employed. 2. Those in which agitation is effected by a strong current of air entering the bottom of the apparatus. The author is strongly of opinion that those of the first class are much to be preferred. Agitation by means of air currents is certainly more thorough than by any mechanical device; but when the ready oxidability of petroleum, and more particularly of lubricating oil, and the injurious influence of the acids so produced, are considered, it will be seen that mechanical stirring arrangements are really the more advantageous. In the case of air agitators there is also a much greater tendency toward emulsification, which is very objectionable. The turpidity appearing in finished petroleum, etc., is chiefly due to the presence of organic acids and salts, which gradually separate. The turpidity which badly refined oil sometimes develops in barrels is most likely caused by the action of organic acids on traces of chalk contained in the glues with which the interiors of the barrels are coated.

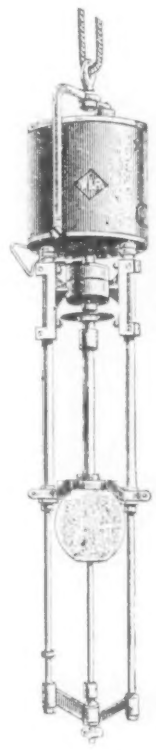
The "Midget" Arc Lamp.

The great economy of arc as compared with incandescent electric lighting has spurred inventors in this field to continued effort to devise a method or plan whereby arcs of comparatively low illuminating power may be brought into more general use. A contemporary, in noting the placing (by Messrs. Woodhouse & Rawson) on the market of a lamp of this type, says:

For large shops or small lecture theaters something between the usual large arc and the ordinary incandescent lamps has long been wanted. It is absolutely necessary not only that these small lamps shall possess perfect steadiness, but also that they should be so simple in construction that they may be relied on for keeping in working order without constant skilled attention.

It is a lamp which fulfills these conditions, and which is strongly recommended for general use, that we now notice and illustrate. It is called the "Midget," from its small size, and is made to give 250-candle power, using 5 amperes at an electromotive force of 45 volts, so that even with this small size of lamp is obtained one candle power of light for the expenditure of every "watt" of electrical energy used.

The illustration shows the general appearance of the lamp. The smallness of the globe prevents any depth of shadow, and minimizes any complaint which may be urged against the inequality of the distribution of the light. The principle upon which the lamp works may almost be called simplicity itself. The upper part of the rods forming the frame of the lamp are hollow, and in these the lower portions slide quite easily. The bottom carbon is attached to the lower part of the frame, which is fastened to the upper portions of the lamp by a chain passing up the hollow pillar forming the upper portion of the lamp, round a pulley wheel whose motion is controlled by clockwork, and then to the upper carbon holder, which acts as a counterpoise and slides freely between the hollow pillars forming the frame of the lamp. The motion of the pulley is controlled by clockwork which is started and stopped by a pivoted bar on whose under surface a number of teeth are situated. These engage a pointer attached to the pendulum of the clock. This bar is pivoted in the center and attached each end to iron plungers which move inside the cores of electro-magnets actuated respectively by the main and shunt circuits. When, owing to the distance between the carbon points, the resistance of the main circuit increases, and consequently the current through the shunt increases, the plunger is drawn further into the core round which the shunt circuit passes, and the pendulum is released, the clockwork moves the carbons nearer together until the main circuit increases so much as to draw the other plunger into the core round which it passes, and so overpowers the effect of the shunt circuit. The bar is drawn down, the



teeth engage the pendulum of the clockwork, and the carbons are maintained apart until, owing to the burning away, the same action is repeated. This action is so delicate that no inconvenience at all is caused by the intermittent feed; indeed it is scarcely noticed. When the current is stopped the pendulum is released owing to the action of a spring upon the bar, and the clockwork causes the carbons to remain together.

In the small box over the upper carbon holder, the current, before passing to the carbon, magnetizes an iron core and lifts the upper carbon a small distance above the lower one, thus forming the arc when the current is first put on the lamp. The carbon is held up in this manner all the time the current is passing through the lamp.

The lamp is wound in different ways, one suitable for parallel working, one for series.

Boiler Deposits.

By Professor Vivian B. Lewes, F. C. S.

Two years ago I had the honor of reading a paper before the Institution of Naval Architects on "Boiler Incrustations," in which I traced the formation of the scale, and the causes which led to the precipitation and hardening of the calcic sulphate, calcic carbonate, magnesic hydrate, and other compounds which are usually found to be present, and I pointed out that the scales formed by various kinds of water were so characteristic that one could speak with certainty as to the kind of water from which the incrustation has been formed by an analysis of the scale itself. The analyses given below may be looked upon as typical of the incrustations formed by fresh water, brackish water, and sea water respectively in marine boilers:

Constituents.	River.	Brackish.	Sea.
Calcic carbonate	75.85	43.65	0.97
Calcic sulphate	3.68	34.78	85.53
Magnesic hydrate	2.56	4.34	3.39
Sodic chloride	0.45	0.56	2.79
Silica	7.66	7.52	1.10
Oxides of iron and alumina	2.96	3.44	0.32
Organic matter	3.64	1.55	trace.
Moisture	3.20	4.16	5.90
	100.00	100.00	100.00

From this it is evident we may look upon the incrustation from fresh water as consisting of impure calcic carbonate, whilst that from sea water is impure calcic sulphate, the brackish water from the mouths of

rivers yielding, as might be expected, an incrustation in which both these compounds are present in nearly equal quantities.

The importance of these differences in the deposit formed is very great, and it enables the shipowner to arrive at a conclusion as to the treatment that the boilers have received during the voyage, by examination and analysis of the scale which those boilers contained. Taking, for instance, the case of a ship which uses fresh water both for filling and make up, it is manifest that on her return to port the scale should be very slight and should consist mainly of calcic carbonate; whilst, if the scale exceeds $\frac{1}{16}$ of an inch and shows a preponderance of calcic sulphate, it is manifest that such scale could only have been formed by sea water, either leaking in from faulty condensers or being deliberately fed into the boilers.

The reception you were kind enough to give that paper, and the frequency with which it has been quoted since lead me to hope that, in continuing and completing the subject, I shall be performing a not unwelcome task. So far, the deposits taken into consideration have been those formed from the impurities natural to the water itself; but with the introduction of high pressure steam a new and highly dangerous form of deposit has added to the trouble of the marine engineer. As early as 1878 the collapse of the furnaces of the boilers of the s.s. "Ban Righ" and a similar misadventure in the screw tug "Ich Dien," with no apparent cause to bring about the damage, caused some attention to be paid in marine circles to the action which had taken place, and the only clue to be found was that a certain amount of oily deposit had formed on the the tops of the furnaces, and experiments made by Mr. Dunlop, of Port Glasgow, led to the conclusion that this oil, which had distilled into the boiler from the lubricants used in the cylinder, was so bad a conductor of heat that its formation on the plate allowed them to get superheated, with the result that they were unable to withstand the pressure of steam existing in the boiler, and in this way brought about the collapse. Similar cases of collapse became frequent after that date, no less than thirty vessels being disabled from this cause during the last few years.

The first case which came under my notice, in which damage to boilers had arisen from this cause, was the case of a large ocean steamer, and through the kindness of Mr. Milton, chief superintendent engineer of Lloyds, I was able to obtain samples of deposit from all parts of the boilers, and full particulars of the case. The steamer was a large one trading between Liverpool and Boston, averaged 12 days on the voyage, and was fitted with ordinary compound engines. She had 3 double ended boilers, with 3 plain furnaces at each end, and 3 combustion chambers in each boiler. The furnaces were plain in one length and connected at the back to the tube plates, being flanged up inside the chamber, whilst the front end plate is flanged inward on to the furnace crowns. The furnace crown was $\frac{1}{2}$-inch plate, and the front bottom plate $\frac{1}{16}$, the working pressure being 80 lbs. The boilers are about five and a half years old, and have always been refilled with fresh water at the end of each run, both at Boston and Liverpool; whilst, as a rule, the waste on the voyage was made up by the use of about 70 tons of fresh water, but during the last voyage sea water was used for this purpose. Every four hours whilst under steam 4 lbs. of soda crystals were put in the hot well, making about 2 cwts. during the run, the total capacity of the boilers being about 81 tons. For lubricating purposes about seven pints per day of valvoline were used in the cylinders. When in port the boilers were allowed to cool down, and the water was run off, and they were swept down with stiff brushes, and were afterwards sluiced out with a hose shortly before being refilled with fresh water. No trouble occurred with the boilers until five voyages before the final collapse, when some of the furnaces began to creep in; they were stiffened with rings and stays, and on the succeeding voyages the whole of the furnaces got out of shape, one after another. Examination of these boilers clearly showed that they had never been very heavily scaled, as in parts of the boiler where it would have been impossible to get at them to clear them out, no signs of heavy incrustation were to be found, and the absence of marks of scaling tools also showed that they had never been allowed to get very dirty. On the furnace crowns, where they had collapsed, there was only a slight white scale, not more than 1-64th of an inch in thickness, whilst on the bottom of the furnaces there was a brown oily deposit $\frac{1}{16}$ of an inch in thickness, which in other parts of the boilers increased to between $\frac{1}{8}$th and $\frac{3}{16}$ of an inch. I obtained from Mr. Milton samples of the thin scale from the top furnaces, and of the deposit from various parts of the boiler, and also specimens of cut-out portions of the boiler plates, Liverpool water, valvoline and soda crystals put into feed water, and of all these analyses were made. The boiler plates were as good as the day they were put in, and showed no structural signs of having undergone any change, whilst the analyses of the Liverpool water and the soda crystals used showed that they could have taken no part in the action which had led to collapse.

I.—*Valvoline.*

The valvoline on analysis gave—

Vegetable and animal oil	nil.
Mineral oil	100 per cent.
Acids (free)	nil.
Boiling point	371° C.
Specific gravity	0.889

II.—*Scale from Furnace.*

	From Top.	From Below.
Calcic sulphate	84.87	59.11
Calcic carbonate	5.90	6.07
Magnesic hydrate	2.83	11.29
Iron, alumina, and silica	2.37	2.85
Organic matter and oil	3.23	19.54
Moisture	0.80	1.14
Alkalies	nil.	nil.
	100.00	100.00

III.—*Deposit from Tubes.*

	Scale on Tubes.	Deposit Above Scale
Calcic sulphate	50.92	11.60
Calcic carbonate	4.18	0.82
Magnesic hydrate	14.12	22.21
Iron, alumina, silica, etc	7.47	9.14
Organic matter and oil	21.06	50.20
Moisture	1.17	4.23
Alkalies	1.08	1.80
	100.00	100.00

IV.—*Deposit from Bottom of Boiler.*

Calcic sulphate	22.52
Calcic carbonate	nil.
Magnesic hydrate	7.09
Silica, alumina, and iron	34.85
Organic matter and oil	27.95
Moisture	5.79
Alkalies	1.80
	100.00

On careful examination of the organic matter and oil present in these deposits, it was found that quite one half of it was "valvoline," in an unchanged condition, which had collected round small particles of calcic sulphate.

A consideration of these analyses, at first sight, yields no clue as to the cause of the collapse, the scale upon the furnace tops being not only free from oil, but perfectly harmless both in quantity and quality; but, on going more deeply into the question, it is evident that this scale cannot be in the condition in which it was originally formed, as the deposits from both top and bottom of tubes, from the bottom of the furnaces, and from the shell of the boiler, are all rich in oily matter; and it is impossible that, during this disposition, the furnace tops could have escaped while all other parts of the boiler became coated with it. Experiments, however, reveal the actions which had been at work and led to the formation of the deposit, and its absence upon the injured portions of the plates.

The pressure at which the boilers were worked was 80 lbs., corresponding to a temperature of 155° C., or 311° F., which is so far below the boiling point of the valvoline that it was evident that it had not distilled over in the ordinary way, and experiments were made to see if it could be distilled in steam at a lower temperature. A retort containing valvoline was carefully heated over a sand bath, its temperature being ascertained by a thermometer, and steam was then blown through it, with the result that at 248° F. or 120° C. the steam became "greasy" and the oil commenced to pass over with it.

This experiment is, I think, important, as it shows that in testing the capabilities of a lubricant, the fact that it has a boiling point well above the temperature of the steam is no guarantee that none of it will find its way into the boiler. Having thus entered the boiler, the minute globules of oil, if in great quantity, coalesce to form an oily scum on the surface of the water, or, if present in smaller quantities, remain as separate drops, but show no tendency to sink, as, their specific gravity being 0.889, they are lighter than the water, and the difference in gravity is probably even greater at the temperature existing in the boiler. Slowly, however, they come in contact with small particles of calcic sulphate

and other solids separating from the water, and, sticking to them, they gradually coat the particles with a covering of oil, which in time enables the particles to cling together or to the surfaces which they come in contact with. These solid particles of calcic carbonate, calcic sulphate, etc., are heavier than the water, and, as the oil becomes more and more loaded with them, a point is reached at which they have the same specific gravity as the water, and then the particles rise and fall with the convection currents which are going on in the water, and stick to any surface with which they come in contact, in this way depositing themselves, not as in common boiler incrustations, where they are chiefly on the upper surfaces, but quite as much on the under sides of the tubes as on the top, their position being regulated by whether they come in contact with the surface whilst descending or ascending.

The deposit so formed is a wonderful non conductor of heat, and also from its oily surface tends to prevent intimate contact between itself and the water. On the crown of the furnaces this soon leads to overheating of the plates, and the deposit begins to decompose by the heat, the lower layer in contact with the hot plates giving off various gases which blow the greasy layer, ordinarily only 1-64th of an inch in thickness, up to a spongy, leathery mass often ¼th of an inch thick, which, because of its porosity, is an even better non-conductor of heat than before, and the plate becomes heated to redness, and, being unable to withstand the pressure of steam, collapses. During the last stage of this overheating, however, the temperature has risen to such a point that the organic matter, oil, etc., present in the deposit burns away, or more properly speaking, is distilled off, leaving behind, as an apparently harmless deposit, the solid particles round which it had originally formed.

Such a deposit is much more likely to be produced with boilers containing fresh or distilled water, as the low density of the liquid enables the oil matter to settle more quickly, whilst with a strongly saline solution it is very doubtful if this sinking point would ever be reached; it is evident also that, when oil has found its way into the boiler and is causing a greasy sum on the surface, the most fatal thing that can be done is to blow off the boilers without first using the scum cocks, because as the water sinks so the scum clings to the tops of the furnaces and other surfaces with which it comes in contact, and, on again filling up with fresh water, it still remains there, causing rapid collapse.

A very remarkable instance of this is to be found in the case of a large vessel in the Eastern trade, in the boilers of which an oil scum had formed. The ship having to stop some days at Gibraltar, the engineer took the opportunity of blowing out his boilers, and refilling with fresh water, with the result that, before he had been 10 hours under steam, the whole of the furnaces had come in.

Under some conditions the oil-coated particles coalesce and form a sort of floating pancake, which, sinking, forms a patch on the crown of the furnaces at one particular spot, and under these conditions the general result is the formation of a "pocket."

A curious fact, which is worthy of attention, is that in most of these oily deposits copper is to be found in considerable quantity. In an analysis of deposit from the furnace of a vessel in which a "pocket" had formed from the above mentioned cause, the scale showed, as in the case already cited, no reasonable cause for the injury at the damaged part of the boiler, whilst the deposit from the under side of the furnace tubes showed clearly the presence of large quantities of oil matters, which were partly combined with copper:

Constituents.	Scale.	Deposit.
Calcic sulphate	90.354	1.02
Calcic carbonate	1.200	*nil.*
Ferric oxide Oxide of alumina	3.200	56.90 2.30
Oxide of copper	*nil.*	1.90
Magnesic hydrate	2.821	1.80
Organic matter Oil	1.600	10.46 17.84
Sand, etc	0.825	7.78
	100.000	100.000

It is a fact that even mineral oils have a considerable solvent action upon copper and its alloys, and it is evident that the copper in the oily deposits have been obtained from the fittings of cylinder and condenser. Fortunately, this copper is so well protected by oil that in most cases it is extremely unlikely to come in contact with, and deposit on, the metal of the boiler; but, if it did, very serious galvanic mischief would be the result.

[To be continued.]

EARLY this month the Holly Springs (Miss.) Gas Company's works were a mark for a lightning stroke. But little damage was occasioned.

The Decline of Natural Gas Pressure.

The *American Manufacturer* says that the statistics respecting the different gas fields of western Pennsylvania speak plainly of the decline in pressure and supply of natural gas in this district. From it will be noted the fact that the pressure cannot go down much more without practically failing, or, in other words, be too light to force the gas to the point of consumption—requiring, as is already practiced by one company operating in the Murraysville field, the use of pumps to force the gas through the lines at a suitable pressure.

At the Murraysville gas district the average pressure at the outset of developments in 1886 was 540 pounds. In January, 1890, it had fallen to 220 pounds; and in June of this year it had fallen to 40 pounds.

At the Grapevile district the average pressure at the outset in 1887 was 540 pounds. In January, 1890, it had fallen to 220 pounds; and in June, 1891, to about 40 pounds.

The Bellevernon district, from which much was expected at the time when the Philadelphia Company, at great expense, laid a 30-inch pipe line to tap it, is reported to be about petering out. The Canonsburg district has maintained a higher pressure than any other district, it being now about 125 pounds, having fallen from 450 in 1886. But the gas in this field has not been used as rapidly as in the others. In the six months since January, 1891, the gas supply of the Murraysville district has fallen from 80 pounds to 40 pounds.

In consideration of the above facts, the time when either coal or artificial fuel gas must be used in many places now supplied with natural gas would not seem to be far off.

Rope Driving for Large Powers.

In a paper read at the Richmond meeting of the American Society of Mechanical Engineers, Mr. C. W. Hunt says: "The transmission of power by cotton or manilla ropes was a few years ago an experiment. It passed the experimental stage, and its use has spread with remarkable rapidity both in England and the United States, and promises at the present rate of increase, to become a formidable competitor with gearing and leather belting for use where the amount of power is large or the distance between the power and the work is comparatively great. In many of the early applications so great a strain was put upon the rope that the wear was rapid. Installations which have been successful, as well as those in which the wear of the rope was destructive, indicate that 200 lbs. on a rope 1 inch in diameter is a safe and economical working load. This makes the normal working load equal to $\frac{1}{35}$ of the breaking strength and about $\frac{1}{25}$ of the strength at the splice. The actual loads are ordinarily much greater, owing to the vibrations in running, as well as from imperfectly adjusted tension mechanism. At a speed of above 80 feet per second the centrifugal force increases faster than the power from increased velocity of the rope, and about 140 feet per second equals the assumed allowable tension of the rope. Computing this force at various speeds and then subtracting it from the assumed maximum tension, we have the force available for the transmission of power. The whole of this force cannot be used, because a certain amount of tension on the slack side of the rope is needed to give adhesion to the pulley. What tension should be given to the rope for this purpose is uncertain, as there are no experiments which give accurate data, and at the present time a decision must be made partly from experience. The first cost of the rope will be smallest when the power transmitted by it is greatest, and, under the assumed conditions, will be a minimum for a given power when the velocity of the rope is about 80 feet per second. The ratio of the first cost of the rope running at any other speed will be—

$$\text{Ratio of first cost} = \frac{\text{H. P. at 80 feet per second}}{\text{H. P. at required speed.}}$$

The wear of the rope is both internal and external; the internal is caused by the movement of the fibers on each other, under pressure in bending over the sheaves, and the external is caused by the slipping and the wedging in the grooves of the pulley. Both of these causes of wear are, within the limits of ordinary practice, assumed to be directly proportional to the speed."

Steel Chimneys for Mercantile Buildings.

Steel chimneys are being erected in connection with some of Chicago's tall buildings. The Fair building has at present the tallest under construction. The chimney, when completed, will be 250 feet high, being considerably higher than any other in the city, the highest at the present time being the one at the Gottfried Brewing Company's plant at Archer

and Stewart avenues, which is 175 feet. The outside diameter is 9 feet 5 inches, while the steel varies in thickness from $\frac{5}{16}$ at the top to $\frac{3}{8}$ inch at the bottom. The lower 75 feet of the chimney is lined with fire brick 8 inches deep, formed to fit the shell compactly all around. Above this it is lined with hollow tile. This lining is supported at intervals of 25 feet by angle iron riveted to the steel shell; in other words, the chimney is lined in a manner similar to blast furnaces and foundry cupolas, and no expansion by heat can lessen its strength. The joints are all hot riveted. The steel shell is carefully protected from corrosion and from any attacks by the weather by painting inside and out. The weight of the chimney is spread to the foundations in the same general way as that of the columns of the building, the base or foundation on which it rests being constructed in the same manner. The ground is first covered with a layer of cement, then two layers of steel rails in cement and one layer of I-beams, on which the cast iron shoe which takes the shell of the stack rests. The capacity of the chimney is 12 60-inch boilers 20 feet in length.

This is the first time this material has been used in the construction of the chimneys of mercantile buildings. The magnitude of the building and the necessity of economizing in space, the foundations for the columns occupying about all the ground, led the architects to adopt steel as the material for this purpose. Brick has been used almost entirely heretofore, but upon investigation it was found that the weight of a brick chimney of this size would be almost 700 tons, while of steel construction it would weigh, including the linings, a little less than 250. The outside diameter of the present chimney is 9 feet 5 inches, while, were it constructed of brick, it would be 16 feet 6 inches, thus making a great saving in space. Another consideration was the time consumed in construction. A brick chimney of this height, 250 feet above the sidewalk, should not be built faster than 2½ feet a day on account of the settlement and the setting of the mortar, while of steel it can be erected at the rate of 20 feet a day. Another important consideration is that it costs only about 60 per cent. of what a brick chimney would cost. Steel has been used in the construction of chimneys for iron mills and factories.

The Charge of Judge Gunnison (Erie, Pa.) to the Jury that Tried the Case of the Local Natural Gas Company vs. Nicholson.

The following is the charge of Judge Gunnison to the jury in respect to the case of the local natural gas company against a resident of Erie, Pa., charged with purloining gas from the company's mains. The jury found the defendant guilty:

Larceny is the felonious taking and carrying away of the personal property of another. You have heard the ruling of the court upon the question raised by counsel for the defendant, in which it was decided, in accordance with the decisions of several other courts of this State, that gas in the distributing pipes of the gas company is personal property, and the subject of larceny. Gas in the ground before the well is drilled would be real estate or a portion of the real estate. But when the well is drilled and the gas flows from the well into the pipe, what is called in law a "severance" takes place. The gas is severed from the real estate, and thereupon becomes personal property. In the same manner, to take apples from a tree in an orchard is not larceny, because they are part of the real estate when attached to the tree; but when the apples are severed from the tree and fall to the ground, to pick them up with the purpose of appropriating them to one's own use might be larceny, because the apples being then severed from the tree become personal property. As long as gas is stored in the earth, it is real estate; it is a part of the earth; but when it becomes severed from the earth by being taken into the distributing pipes of the company and brought (as in this case) 80 miles from where it was stored in the earth, it becomes personal property and is the subject of larceny. So that if the defendant is guilty of feloniously taking and carrying away the gas of the Pennsylvania Gas Company, in the city of Erie, where it has been brought by pipes, he is guilty of larceny.

The testimony introduced on the part of the commonwealth is to the effect that upon October 1, this defendant appeared at the office of the company, he having been before that a customer of the company, and one to whom they had supplied their gas, and notified them to disconnect his stove from the pipes. That thereupon they sent a man to his premises who took away the mixer (which you probably all know is the globe or bulb attached to the pipe just before the point at which the gas enters the stove). That they detached the mixer and disconnected the pipe from the stove to prevent the gas from escaping. That, on February 12, when one of their employees visited the premises of the defendant, they found the pipe connected with the stove again, and a piece of pipe with holes drilled in it, to mix the air with the gas, attached to it, and a fire burning in which the fuel used was gas. He says that he turned the gas off and turned it on again and lighted it, and found that it was gas. Now it is a principle of criminal law that a person found in possession of stolen goods must give a satisfactory account of his possession, or that possession will be taken as evidence of guilt. The defendant has introduced no testimony and called no witness to make a satisfactory explanation of the presence of the gas which was burning in the stove during this time. Of course, there is the evidence of Mr. Walker, who tells you that at the office of the company the defendant told them to disconnect the gas on these premises, but that is the only evidence that shows it was in his possession or that he occupied these premises, because all that the other witnesses know about it is hearsay alone. They got word at the office to go and turn of the gas at Mr. Nicholson's place, but that would be all hearsay. But the testimony of Mr. Walker is to the effect that the defendant himself came to the office and told them to turn off the gas, and that he gave the building and rooms which he occupied, and that his declaration that he occupied the rooms would be evidence against him. It might be possible that the gas was not burned there with his knowledge and consent. There is no direct evidence that he ever saw the gas burning there, or that he knew of it. The circumstance that the gas was found burning on the premises and connected with the stove would be a circumstance from which you might legitimately infer that it was he who did it or it was with his consent it was done. The indictment charges him with having taken 120,000 feet of gas. It is not requisite that the commonwealth prove that he used all that amount; if they prove he used any gas at all, it will be sufficient. Frequently an indictment is found against a man for stealing a large amount of property, and when the proof is presented there may be only evidence to show that he stole one or more of the articles alleged to have been taken; but it is not neccessary to prove that he stole all the articles named in the indictment. So if you find this gas was being burned in these premises by his knowledge and consent, in the absence of any testimony to contradict it or to explain the situation and the transaction, you will be justified in finding that he is guilty. It would be sufficient proof to justify such a verdict.

But, as in all other criminal cases, before returning a verdict of guilty you must be satisfied beyond a reasonable doubt that it was burned with his knowledge and consent; because if it was done without his knowledge and consent, he would not be guilty of the crime, although he might be liable civilly for the gas that was taken, but he would not be guilty of any crime, because it is necessary, in order to convict a man of crime, to show that he had a guilty intent, and if it was done in his absence, when he knew nothing about it, he would not be guilty of any crime. But intent is something that may be inferred from the circumstances, and if the circumstances satisfy you beyond a reasonable doubt that he had knowledge of the fact that this gas was being burned there, then you might properly infer that there was a guilty intent. Intention is a subject of proof by means of circumstances, and that one circumstance would be sufficient from which to infer that intent, if you find that it was with his knowledge and consent. You cannot find, however, from mere susp'cion; you must find it upon evidence, and if there is a reasonable doubt in your minds arising from the evidence, such a doubt as a man of ordinarily good judgment would act upon in matters of importance to himself, that reasonable doubt should be given to the defendant, and he should be acquitted.

Counsel for the defendant asks the court to instruct you that in order to convict the defendant of this charge the jury must be satisfied beyond a reasonable doubt that natural gas in pipes, such as is shown by the evidence of the prosecution, is such personal property as comes under the common law definition of personal property, and as such personal property is the subject of larceny at common law.

That point is affirmed; but you are instructed by the court that in our opinion natural gas, in the situation in which this was, is personal property and property of value. The fact that an amount of small value is proved to have been taken does not change the nature of the transaction at all. Larceny can be committed as well of one cent as of $1,000; the crime is the same. This being a felony, you have nothing to say about the costs.

Text of the Decision in the Case of the Edison Electric Light Company vs. The United States Electric Lighting Company.

Judge Wallace, in deciding the above-named case, which has occupied his attention for several months, submitted the appended opinion:

Two claims of letters patent, No. 223,898, granted Thos. A. Edison, January 27, 1880, for an improvement in electric lamps, are in contro-

versy in this suit. These are claims 1 and 2. It is not asserted for plaintiff that the defendant infringes the other claims of the patent, consequently they will require no attention further than to see whether their terms may assist in defining the meaning of the claims in litigation.

The plaintiff contends that these claims are for fundamental inventions of great merit, and are entitled to a construction by which every incandescent lamp for electric lighting, consisting essentially of a filamentary carbon burner, hermetically sealed in a glass vacuum chamber, is within their terms. The defendant contends that unless the claims are limited to narrow inventions, not employed by the defendant, they are invalid for want of patentable novelty. The questions of the validity and scope of the patent have been adjusted in the courts of England and Germany with a diversity of opinion by the judges who have considered them. The specification is a perplexing one. The difficulty lies in its shadowy demarkation of the line between the essential and non-essential features of the invention described. It catalogues a number of discoveries which Mr. Edison had made ; it sets forth some of the essential features of the lamp, and then it leaves to be found by inference from generalities what the elements are of the combinations included in the extremely elastic terms of the two important claims.

Nevertheless, when a sufficient knowledge of the prior state of the art to which it relates has been acquired, the new departures from the old devices which it describes, and which, presumably, the inventor proposed to incorporate into the claims of his patent, are reasonably apparent. The specification states that the object of the invention is "to produce electric lamps giving light by incandesence, which lamps shall have a high resistance so as to allow of practical subdivision of the electric current into numerous small units and their conversion into luminous centers." By practical subdivision is meant a distribution and division of the current and its conversion into lights comparable with those of ordinary gas jets, on a scale and under conditions of convenience and economy adequate to a system of illumination for domestic purposes in villages and cities analogous to that of gas. Prior to 1879 there was no method known by which this could be done practicably. The problem involved the perfection of devices for the proper distribution and regulation of the current as well as those for translating it into the light. No reference to the pre-existing devices for generating electricity, conducting it to the translating devices, or regulating its pressure or quantity, is necessary except to state that the principles governing the relation of the resistance of translating devices to the character of the circuit in which they are arranged, whether in series or in multiple arc, were well known to electricians, and had been applied in various forms of electrical apparatus. They were two well known devices for converting the current into light—the arc lamp and the incandescent lamp. In the former the current is forced to leap an air gap separating the two conductors, usually of carbon, and in overcoming the resistance of the air space heats the adjacent surfaces of the conductors and produces a light of great intensity. In the latter light is produced by the incandescence of an electrical conductor, a conducting strip of burner, placed in a continuous circuit through which the current passes and which develops heat by its resistance to the flow. The arc lamp was suitable for use in streets, open spaces and large halls, but its light was too concentrated and powerful for the illumination of dwellings or of rooms of small dimensions. It was the generally accepted opinion of electricians that the hope of progress in the subdivision of the electric light was to be found in modifying the features of the arc lamp. The reason for this conclusion need not be mentioned; it suffices to say that Mr. Lane-Fox in England and Mr. Edison in this country seem to have been the only notable dissidents, and each of them had expressed the conclusion that subdivision might be accomplished by the incandescent lamp when provided with a conductor of high resistance and small radiating surface arranged in system of multiple arc. Lane-Fox had set forth the advantages of such a lamp in three patents granted to him in England, two in October, 1878, and one in March, 1879, and in a letter to the London *Times*, published in December, 1878 ; and Mr. Edison had done so in a patent granted to him in France, May 28, 1879, for improvements in electric lighting.

By arrangement in multiple arc no greater electromotive force is required for a large number of translating devices than for a single one, and the amount of current can be graduated to the number employed ; consequently, a lamp with a conductor of high resistance can be utilized as efficiently as one with a conductor of low resistance. Higher resistance in the conductor permits the use of a weaker current, and, consequently, of smaller and less expensive main conductors. With a small surface of conductor less energy is required to produce a candle power, and the small incandescent mass will radiate a moderate light, like the domestic lamp. Electricians knew how to make conductors of high resistance, and how to make them with a small radiating surface. They knew that with the materials of the same specific resistance the total resistance of the conductor could be varied by varying its length and cross section. They knew what materials were preferable and what processes of treatment to make conductors of high or low resistance.

If they had only known how to construct a lamp in which the conductor would have adequate mechanical strength and durabilitv for practical commercial use, while having the small radiating surface and high resistance desirable, there would have been nothing wanting, and electric lighting by incandescence would soon have been an accomplished fact. Although Lane-Fox and Edison had contributed to the state of the art the recognition of the principle that the conductor must have high resistance and small radiating surface, and each of them had embodied the principle in lamps for which they had severally obtained patents, neither of them had invented a lamp which satisfactorily embodied all the conditions of success, because a burner of the necessary material, form and complementary adjuncts was yet to be devised. As to material, experiments had been tried with platinum, iridium and alloys of these metals, and with carbon of various kinds. It was known that platinum, being a poor conductor, could be readily brought to incandescence by the electric current, but to do so it was necessary to raise a temperature very near the fusing point, and a minute increase would melt it. On the other hand, carbon was known to possess at an equal temperature much greater power of radiation than platinum, but the difficulty was that it would combine with oxygen at high temperature and rapidly disintegrate. It could only be used, therefore, in a vacuum, which is practically unattainable. From the earliest lamp (disregarding the Geissler tube, because it has no burner in the true sense) patented in England by King in 1849, to the latest examples, like those of Lane Fox or Edison's platinum lamp, patented in 1878-9, the history of the art shows a variety of experiments to perfect a lamp in which a carbon burner or a platinum burner would have sufficiently long life for practical requirements. The result of these experiments may be succinctly shown by quoting two well-known electricians. Mr. Schwendler, in an article published in 1879 in the *Telegraphic Journal*, said: "Unless we shall be fortunate enough to discover a conductor of electricity with a much higher melting point than platinum, and the specific weight and specific heat of which conductor is also much lower than for platinum, and which at the same time does not combine at high temperatures with oxygen, we can scarcely expect that the principle of incandescence will be made use of for practical illumination." Mr. Sawyer, in a patent to Sawyer & Man, granted in June, 1878, said: "At the present day it is not new to produce a light by causing the electric current to heat a carbon conductor to incandescence in a vacuum, or in nitrogen, or in other gas; but no lamp has yet been devised which would be practically operative, and for these reasons: First, the methods which have been adopted for charging the lamp with the artificial atmosphere, such as a displacement of mercury, water or air by the gas, or the combustion of phosphorus in the lamp, are imperfect. A perfect vacuum is unattainable. Some oxygen or other element or compound remains in the lamp, and slow combustion or disintegration takes place, for the remaining gas or vapor other than hydrogen or nitrogen attacks the carbon, which, in turn, is decomposed, with a result of depositing some carbon upon the globe and setting free the oxygen to attack fresh carbon. Second, it has been found practically impossible under the varying degrees of heat and pressure to maintain perfect joints, and the result is that expansion of the artificial atmosphere by the heat from the luminous conductor expels a portion of the same, and the contraction of the atmosphere upon cooling causes a portion of the external air to penetrate the globe, thus supplying oxygen which at the least lighting feeds upon the carbon. Third, the unequal expansion of the carbon and its holders has resulted in fractures of the former, so that, however perfect the atmosphere in the globe, the lamp has never been permanent."

The most advanced type of carbon burner lamps in 1875 were the lamps of Lodyguine or of Konn, and until the spring of 1879 lamps like those of the Sawyer & Man patent or the patents of Mr. Farmer. It was thought to be the merit of Lodyguine's lamp that it obviated the difficulty of the short life of the burner by using two burners, rods of diminished section at the luminous focus. on a glass receiver, hermetically sealed and filled with nitrogen, electrically arranged so that the current would be passed to the second carbon when the first had been consumed. Konn provided his lamp with five carbon burners in the form of rods or pencils, and devices for bringing them successively into circuit. In the lamp of Sawyer & Man the carbon burner was a rod or pencil maintained in a globe charged with nitrogen gas, and the globe and its stopper (both of glass) were held together by a clamping device. In the lamp of the patents granted to Mr. Farmer, in March, 1879, the burner

was a carbon rod or pencil inclosed in a globe filled with hydrogen or other analogous gas, and the globe was closed by a rubber stopper. In none of the lamps, except the one described in Mr. Edison's prior French and English patents of 1879, had any attempt been made to make the vacuum chamber wholly of glass with the parts sealed together by fusion, or to seal the conducting wires leading to the burner through the glass by fusion of the glass. The impracticability of maintaining a carbon burner under such conditions that it would be sufficiently durable has apparently so impressed those who were studying lighting by incandescence that as late as in the early part of 1879 both Lane-Fox and Edison were trying to perfect a burner of other material. Edison's burner in his French patent of May 28, 1879, was of platinum wire coiled upon a bobbin composed of an infusible oxide, and Lane Fox's burner in his patent of May 14, 1879, was of platinum-iridium alloy, or of spiral strips of metal surrounding a tube of glass, fireclay, steatite or lime, with the surface of the metal strips covered with asbestos, or some vitreous material.

This cursory view of the prior state of the art is sufficient for an intelligent reading of the specification. The specification describes the general nature of the invention as follows:

"The invention consists in a light giving body of carbon wire or sheets coiled or arranged in such a manner as to offer great resistance to the passage of the electric current, and at the same time present but a slight surface from which radiation can take place.

"The invention further consists in placing such burner of great resistance in a nearly perfect vacuum to prevent oxidation and injury to the conductor by the atmosphere. The current is conducted into the vacuum bulb through platina wires sealed into the glass.

"The invention further consists in the method of manufacturing carbon conductors of high resistance, so as to be suitable for giving light by incandescence, and in the manner of securing perfect contact between the metallic conductors or leading wires and carbon conductors."

The specification then recites that previously light by incandescence had been obtained from rods of carbon of one to four ohms resistance placed in closed vessels in which the atmospheric air had been replaced by gases that did not combine chemically with the carbon; that the vessels holding the burner had been composed of glass cemented to a metal base; that the connection between the leading wires and the carbon had been obtained by clamping the carbon to the metal; that the leading wires had always been large, so that their resistance should be many times less than the burner, and generally the attempts of previous persons had been to reduce the resistance of a carbon rod. It then points out the disadvantages of such a lamp, stating that it could not be worked in great numbers in multiple arc without the employment of main conductors of enormous dimensions; that, owing to the low resistance, the leading wires have to be of large dimensions and good conductors, and a glass globe cannot be kept tight at the place where the wires pass in and are cemented, and consequently the carbon is consumed because there must be almost a perfect vacuum to render it stable, especially when it is small in mass and high in electrical resistance; and that the use of gas in the receiver at the atmospheric pressure serves to destroy the carbon by attrition.

The specification then states in substances that the patentee proposes a new departure; that he has discovered that even a cotton thread properly carbonized and placed in a sealed glass bulb exhausted to one millionth of an atmosphere offers from 100 to 500 ohms resistance to the passage of the current, and that it is absolutely stable at very high temperature; that if the thread be coiled as a spiral and carbonized, or if a fibrous vegetable which will leave a carbon resistance after heating in a closed chamber be so coiled, as much as 2,000 ohms resistance may be obtained without presenting a radiating surface greater than three-sixteenths of an inch; that if such fibrous material be rubbed with a plastic compound of lampblack and tar its resistance may be made high or low, according to the amount of lampblack placed upon it; that carbon filaments may be made by a combination of tar and lampblack, the latter being previously ignited in a closed crucible for several hours, and afterward moistened and kneaded until it assumes the consistency of thick putty; that small pieces of this material may be rolled out in the form of wire as small as seven one-thousandths of an inch in diameter and over a foot in length, and the same may be coated with a non-conducting, non-carbonizing substance and wound on a bobbin, or as a spiral, and the tar carbonized in a closed chamber by subjecting it to a high heat, the spiral after carbonization retaining its form; that he has carbonized and used cotton and linen thread and splints, papers, coiled in various ways, also lampblack, plumbago and carbon in various forms, mixed with tar and kneaded so that the same may be rolled out into wires of various lengths and diameters; that each wire should be uniform in size throughout; and all those forms are fragile and cannot be clamped to the leading in wires with sufficient force to insure good contact and prevent heating; that if platinum wires are used and the plastic lampblack and tar material be moulded around it in the act of carbonization, there is an intimate union by combination and by pressure between the carbon and platinum, and nearly perfect contact is obtained without the necessity of clamps; that the burner and leading wires should be connected to the carbon ready to be placed in the vacuum bulb, and when fibrous material is used the plastic lampblack and tar should be used to secure it to the platina before carbonizing.

The specification proceeds as follows:

"By using the carbon wire of such high resistance I am enabled to use fine platinum wires for leading wires, as they will have a small resistance compared to the burner, and hence will not heat and crack the sealed vacuum bulb. Platina can only be used, as its expansion is nearly the same as that of glass.

"By using a considerable length of carbon wire and coiling it, the exterior, which is only a small portion of its entire surface, will form the principal radiating surface; hence I am able to raise the specific heat of the whole of the carbon, and thus prevent the rapid reception and disappearance of the light, which on a plain wire is prejudicial, as it shows the least unsteadiness of the current by the flickering of the light, and if the current is steady the defect does not show."

The specification then gives directions for carbonizing the carbon thread in a manner to prevent its distortion, for blowing a glass bulb over it after it is formed, for exhausting the glass bulb, and for hermetically sealing the bulb when a high vacuum has been reached.

[To be concluded.]

Asphaltum.

Mr. E. W. Parker, in a census bulletin relating to mineral industries, makes the following interesting statements respecting asphaltum. In his account he relates that gilsonite, elaterite, uintite, wurtzilite, albertite, grahamite, asphaltum, maltha, and brea are names given to various semi-solid bitumens which differ considerably from one another in their chemical composition, in their action with acids or other agents, and upon the application of heat; but asphaltum is the common term applied to the class when used industrially, the varieties being designated by the producing locality. They are, moreover, used in the main for the same purposes.

Elaterite, albertite, and grahamite are very nearly alike in composition and physical properties. The first occurs principally in Derbyshire, England, and was so named by Hausmann, on account of certain elastic tendencies and its resemblance to india-rubber. Albertite, a very similar mineral, occurs in Nova Scotia. Grahamite was found in West Virginia, but the deposit was small and has been exhausted.

Gilsonite and uintite (or uintahite) are names given to the asphaltum of Utah, which is the purest that has yet been found, the crude mineral containing about 90 per cent. of bitumen. It was discovered by Mr. S. H. Gilson, of Salt Lake City, by whose name the mineral is generally known in commerce, and by the Gilson Asphaltum Company, of St. Louis, engaged in its mining, although mineralogists prefer to treat it under the name uintite, given it by Prof. W. P. Blake in the first article published on the subject, from the producing locality, near the Uintah mountains. The gilsonite deposits in Utah lie in the northeastern part of the territory, near Fort Duchesne, and just east of the Uintah reservation. Other fine deposits exist in the Uncompahgre Ute reservation, a short distance from the Colorado State line. During the last session of Congress an unsuccessful effort was made to open to settlement the land on which these deposits lie, which is that known as the "Twelve-mile strip," embracing two rows of townships on the bank of White river. The mineral is found in veins having nearly a perpendicular dip, and are said to be of good thickness and in a position to be easily mined.

Near the locality from which gilsonite is obtained is a deposit of another peculiar form of bitumen, to which Prof. Blake has given the name of wurtzilite. This mineral occurs in Wasatch county, Utah, between Salt Lake City and the Green river valley. When first discovered it was thought that a mineral form of caoutchouc had been found, but this assumption was soon disproved by tests showing that it had no tensile elasticity and would not yield to the usual dissolving agents. It was then classed as a species of elaterite, but Dr. Henry Wurtz, after a thorough investigation, has shown it to be an entirely different mineral. No wurtzilite was mined commercially during the calendar year 1889.

Although for a number of years asphaltum in different forms has been known to exist in California in large quantities, it was not until

1888 that its production assumed any important proportions as an industry. In 1888 a large deposit of bituminous rock containing an unusually large percentage of asphaltum was discovered in Ventura county, and a company of San Francisco capitalists was organized for the purpose of developing and operating it. The owners styled this mineral "asphaltum," but as it contains but 24 per cent. of bitumen, the other constituents being silica (about 64 per cent.), oxide of iron and calcium carbonate, it should be classed among the bituminous rock products.

There are several deposits of bituminous rock in San Luis Obispo and Santa Cruz counties, in which the peculiar features of asphaltum formations are strikingly illustrated, clearly showing that they belong to no particular era or age; that they are found at various altitudes, and with no uniform character in appearance, hardness, or chemical composition. Deposits of solid asphaltum and springs of viscid, oily material, commonly called "brea," occur in places not 1,000 feet apart, and yet in strata of unquestionably different periods of formation. A number of companies are now engaged in its production.

Until the remarkable impetus given to the asphaltum industry in California and Utah in 1888, the island of Trinidad and the deposit of Seyssel, in France, and Val de Travers, in Switzerland, furnished the bulk of the world's supply. Cuba produces asphaltum of excellent quality, some of which has been imported into the United States. Venezuela has furnished a small portion of the supply in the past, and a few tons of bituminous limestone are imported annually from Germany and the island of Sicily. In the State of Tabasco, Mexico, large deposits of asphaltum are reported, but, although at a convenient place for shipment over the Mexican National Railway, only a few small lots have been shipped.

The methods of preparing the various asphaltums for street pavement are in a manner similar, yet sufficiently distinct, to justify a brief description of each process. The bituminous limestone of France and Switzerland is prepared by being first ground to a fine powder, then passed through iron cylinders, into which air heated to a temperature of 500° F. is introduced. It is thoroughly stirred as it passes through the cylinders, and when it reaches the opposite end is removed in a plastic condition and spread upon a concrete foundation, compacted by hammers, and when cool the street is ready for use.

The Trinidad asphaltum, upon being unloaded at its point of destination, is placed in large tanks and heated over a slow fire for a few days, care being taken not to heat the mass sufficiently to cause distillation. By this process all foreign substances are eliminated; vegetable impurities rise to the top and are skimmed off, while the earthy constituents settle to the bottom, and the asphaltum is then in a condition for manufacture. For street paving the refined asphaltum is treated with the residuum of petroleum and mixed with fine, sharp sand in the proportion of 14 per cent. by weight or 25 per cent. in bulk of asphaltum. The mixing is thorough, and is made at a temperature of about 300° F. While still hot and plastic it is spread upon the foundation already prepared and rolled by heavy steam rollers. The advantage claimed for the Trinidad asphaltum over the French and Swiss limestone material, lies chiefly in the granular nature of the sand used in preparing it, which prevents the slipping of horses.

Gilsonite is prepared for this purpose by being first pulverized and mixed with petroleum oil. The mixture is then heated, care being taken to keep the temperature below 500° F., as above that temperature gilsonite will decompose. This composite is mixed while heated with broken stone or gravel, and is then ready for the street. It has been ascertained that a mixture of about 80 per cent. gravel makes the most durable pavement.

For the manufacture of street paving from the bituminous rock of Ventura and Santa Barbara counties, California, it is only necessary to mix it when heated with the sand of the locality where it is used. Sand is mixed with the asphaltum in the proportion of from 3 to 8 times by bulk of sand to one of asphaltum. This method effects a considerable saving in transportation expenses. There is no appreciable loss of time in placing it on the street, as it requires only an hour after laying to "set" and be ready for traffic. Once properly mixed and laid, it seems practically indestructible, as shown, it is said, by a section of this pavement which has been in use for 18 months on one of the streets in San Francisco.

The bituminous rock of San Luis Obispo and Santa Cruz counties is a sandstone thoroughly impregnated with bitumen. It is used almost entirely for street paving, and for that purpose is probably more easily and cheaply prepared than any of the asphaltum products. The only treatment necessary is to steam it, so as to thoroughly mix its ingredients and soften it for spreading to a uniform thickness and a smooth, even surface. Bituminous rock has supplied a limited local demand for 10 or 15 years, but it is only during the past two years that it has assumed any commercial importance as an industry. It is reported that pavements made of this material 15 years ago, and used under heavy travel, have recently been removed and found to have lost very little either in weight or thickness; also that it stands equally well the high temperatures of the interior cities, and the cold, damp atmosphere of the coast. It is estimated that there are now 50 miles of bituminous rock street pavement in the State of California.

Although the greatest use for asphaltum is in the manufacture of street paving, it is by no means confined to that field. Large quantities are consumed in making floors for warehouses, cellars, wineries, etc. It renders the floors water tight, and is not affected by acids or gases. For lining dams, levees, and reservoirs a thin coat of asphaltum, put on in a melted state, presents a water-tight surface, preventing loss by seepage. As a coating for piling, wharf timbers, ground ends of telegraph poles, etc., it gives almost absolute protection against, not only the action of air and water, but also the destructive work of insects and barnacles. It is used as a cement for sea walls and other marine architecture, where its water-proof character makes it especially valuable as a binding material. It is claimed to make wood conduits almost, if not quite as durable as iron, and any iron or other metal work such as anchors, etc., coated with it will not rust or be affected by sea water. It is also used as a roofing material, and, being practically a non-conducter of electricity, serves a useful purpose as an insulator for electrical wires. Varnish is manufactured from refined asphaltum or gilsonite by simply heating with spirits of turpentine.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Consolidated Gas Company, at Rochester, N.Y., will build a new works, to be constructed, it is said, on the combined plan—that is, to supply a mixed coal and water gas.

A RECENT issue of the Philadelphia *Telegraph* says that the Welsbach Incandescent Gas Light Company, of Pennsylvania, was dissolved on the 5th inst., at a special meeting held for the purpose of considering the dissolution, at the office of the Company, in Gloucester, N. J. The Company was organized under the laws of the State of New Jersey, which require the written consent of more than two-thirds in interest of all the stockholders to a dissolution. The Welsbach Incandescent Gas Light Company, of New Jersey—the parent Company—has a capital of $9,000,000; the Welsbach Incandescent Gas Light Company, of Pennsylvania, has a capital of $4,500,000, and the Welsbach Incandescent Gas Light Company, of New York, has a capital of $4,500,000. It is now proposed to consolidate the three Companies and shrink this aggregate capital of $18,000,000 capital to $600,000, divided into 120,000 shares of $5 each. The par value of the shares of the three old Companies was $100. One share of stock in the parent Company will be exchanged for one share in the new Company, three shares of stock in the New York Company will be exchanged for one share of stock in the new Company, and three shares of stock in the Pennsylvania Company will be exchanged for one share in the new Company. This plan of consolidation is based upon the relative values of the assets of the respective Companies, and the officers of the Company confidently expect to pay a dividend next year upon the capital stock of the new Company.

THAT plan looks like getting the Company down to a sensible working basis, and were it followed when the determination to manufacture the lamp in this country on a large scale was originally arrived at, we have no doubt that the returns would have been fairly remunerative to those concerned in the parent Company.

THE two suits brought at the instance of the Electric Light Improvement Company, of San Francisco, against David Scannell, Chief Engineer of the Fire Department, and the city and county of San Francisco, have been decided by Judges Hawley and Beatty, in the United States Circuit Court for the district. The actions were instituted with a view to having declared invalid a city ordinance that prohibits the suspension of electric wires over or on the roofs of buildings. The Court decided that the ordinance was valid and dismissed the action.

THE Muscatine (Ia.) Gas, Electric Light and Power Company has been very successful this season in introducing gas cooking stoves. Judicious advertising in the local papers, a good collection of stoves, etc., on display in the Company's office, and liberal treatment of patrons in respect of connecting up the stoves, are mainly responsible for the results so far achieved.

A CORRESPONDENT forwards the following: "The Beverly (Mass.) Gas and Electric Light Company operated the street lights from their new station for the first time on the evening of the 5th inst. Eighty new lamps were supplied with current from two Thomson-Houston 50 arc light dynamos. A slight delay was experienced in starting, but by 8 o'clock both circuits were running. The commercial lighting was, and will for several days, run from the old station. The new station is a brick structure, 110 feet by 45 feet, and is located on River street. Power is obtained from a 300 horse power improved Greene compound condensing engine of the Cross pattern. The station is finished in hard wood, and it is a model station in every respect. Among those present at the time of starting up were Mr. C. F. Prichard, of Lynn, and Messrs. S. W. Winslow, A. W. Rogers, H. F. Winslow and E. J. Hassett. The work of installation was supervised by Mr. McCanley, who hoped to have the rest of the apparatus in operation on the 15th inst.

THE officers of the Washington (Pa.) Gas Company and the Washington Electric Light and Power Company have been removed to South Main street.

THE committee appointed at a recent town meeting at Spencer, Mass., to consider the question of the advisability of engaging the town in the supply of gas and electric lights, held a meeting early this month and organized by selecting A. W. Curtis as chairman. Two sub committees were appointed. The first of these (Messrs. Erastus Jones, W. H. Prouty, and James Hughes) was instructed to examine the condition of the present plant of the Spencer Gas Company, with the right to employ an expert to ascertain the power of the engines, the adaptability of the apparatus, the state of repair, and the cost of removal, should it be thought advantageous to select another site for its location, and any other points that the expert might deem worthy of examination. The second sub-committee (Messrs. J. W. Temple, S. S. Wiggin, and A. H. Sinnott), known as the committee on finances, will interview the proprietors of the Spencer Gas Company in respect to the terms on which the Company will dispose of its works, etc. The whole committee then adjourned, subject to the call of the chairman, when he shall be informed by the sub-committees that they are ready to report.

WE understand that the new Gas Company at River Falls, Wis., proposes to employ the Acme gas process, the essential features of which have been heretofore given in our columns. The River Falls Company is to be pitied.

THE residents of Reading, Mass., are disturbed over the proposition now in process of consideration by the people of the adjoining town of Wakefield—one Gas Company supplies both places—under which the supply of gas and electric light in Wakefield is to be placed in the hands of the local authorities. The Reading *Chronicle*, in discussing the affair, says: "Wakefield has passed a first vote preliminary to the purchase of the gas and electric light plant of the Wakefield Gas Company. Reading's interests would be affected by the proposed transfer in this way. Wakefield under the present legislative enactments can only purchase such of the plant as is within its town limits, and could not lawfully supply gas to any other town, or to any individual not a resident of the town. Therefore, in case of purchase, the question arises as to whether we shall get cut off from our supply of gas. It seems to us that now is the time for our town to take some action in regard to municipal lighting."

ON August 5th the Nordyke and Norman Company, of Huntsville, Ala., filed a bill to foreclose the mortgage on the Huntsville Electric Light Company, and to have a receiver appointed therefor. The Register in Chancery appointed C. F. Sugg, who gave the necessary bonds and took charge.

A QUEER state of affairs is reported from Braddock, Pa., respecting the supply of natural gas in that city. Some time ago the Philadelphia Natural Gas Company shut off the gas from all houses whose occupants refused to pay a considerably higher rate than that formerly charged, a further condition being that a deposit of $10 be made with the Company. On the 4th inst. employees of the Company paid a visit to Washington street with the purpose of cutting out the services of those who refused to comply with the new regulations. Before a single service had been "cut" the workmen were surrounded by an excited crowd of men, women and children. The mob, having been worked up to the proper pitch of excitement, "charged" on the Company's employees. The latter fled, and, for the time being, the local Braddock contingent are having cheap gas.

THE popularity of the Cabot specialties in purifier trays is well attested by the fact that 38 separate orders for the same had been received, up to July 15, this year. These trays easily hold the market.

THE proprietors of the Ishpeming (Mich.) Gas and Electric Light Company have determined to install and operate an electric lighting plant. This decision was prompted by the desire of the authorities to have the streets in the business portion of the town lighted by electricity.

THE miners employed by the Penn and Westmoreland Gas Coal Companies are making bitter complaints that sufficient work is not given them. These men are, it should be remembered, the ones who some time ago would not lift a pick when the companies were all but begging them to go on with their work.

THE Leominster (Mass.) Gas Light Company has added an underground tank, of 6,000 gallons capacity, to its oil storage plant. The Company can now safely store 12,000 gallons of oil.

MESSRS. R. & J. DEMPSTER, of Manchester, England, have been granted English letters patent for improvements relating to apparatus for the removal of sulphate of ammonia from the saturators to the drainers. To accomplish this the patentees propose to employ a pump of any ordinary description, or a centrifugal or other rotary pump. In the former case it would be fixed within the saturator. The suction tube is arranged to extend to nearly the bottom of the saturator; and from the tube a branch tube is connected leading to the drainers. The ends of these tubes are provided (in case an ordinary pump is used) with suitable valves arranged in such manner as to alternately close and open with each stroke of the pump piston; but if centrifugal or rotary pumps are employed, such clacks may be dispensed with. The pump barrel and piston may be constructed at a higher level than those tubes and of larger arch; but a form of pump may be used wherein the piston is below the branch tube, in which case the branch tube will not require a valve or clack; and in case a centrifugal or rotary pump is employed neither of the tubes will require to be provided with clacks. As a precaution against the possibility of drawing the liquid over to the pump barrel, where the ordinary kind of pump is employed, the pump barrel is (by preference) fixed at a sufficient height over the junction to the branch tube; or a syphon pipe of sufficient height may be introduced; or a weighted valve may be employed to accomplish the like object. The pumps and tubes are (by preference) made of lead or copper as a material for the tubes, and india rubber, vulcanite, lead, or other material little influenced by acid ammonia, for the clacks or valves.

THE Scranton (Pa.) Gas and Water Company is putting up a building, 53 feet by 38 feet, which is to be used as a purifying house. This addition will double the purifying capacity of the plant, which was somewhat cramped.

ENGINEER BYRNES, of the Citizens Company, of Brooklyn, N. Y., says that the new distributing station at 65th street and Fort Hamilton avenue, will be completed by October first.

THE dollar rate for gas used at Evansville, Ind., for heating and cooking purposes has "boomed" the day send-out of the Evansville Gas and Electric Light Company, and Mr. Wilkiemeyer intends to keep the "boom" up. The consumers and the new Superintendent are sure to be in accord, for his policy will always be to serve them faithfully in order that his Company may prosper.

A RECENT issue of the Chicago *News* contained the following: "Commissioner Aldrich has decided to issue to the Economic Fuel Gas Company a permit to lay its mains in the streets of Chicago. The decision was arrived at by Mr. Aldrich after a long consultation held with Corporation Counsel Miller. At the conference Mr. Miller took the ground that the City Council, in granting the Economic Company its franchise, acted within its powers, and that the franchise was valid. He advised that the duty of the Commissioner of Public Works was to issue the permit contemplated by the franchise. He informed the Commissioner that it was in his discretion, however, to make such conditions in the permit as would best subserve the public interest, regard being had to the rights of the Company under its franchise. Upon this advice the Commissioner determined to issue a conditional permit—or permits. The points upon which Commissioner Aldrich will insist are that the mains must be laid in alleys so far as that is practicable; that as much of the work as possible be done at night; and that the whole down-town region be not torn up at once. The Economic Company's formal request for a permit will not, therefore, be literally complied with. Mr.

Aldrich has not, so far, indicated what streets his permit will cover, but it is not likely that he will allow more than two, or three at most, of the streets in the heart of the city to be open at once. A conference was also held between Commissioner Aldrich and Manager Yuille of the Economic Company. According to the Commissioner's request, the Company presented a map of their proposed main lines north of 16th street. 'Why,' Mr. Aldrich asked, 'are you in such an extraordinary hurry to get your pipes laid down town? Why not do what you can in districts where you will meet with no opposition, and afterward begin your work in the city proper?' The reply to this was, 'Because the down-town streets are daily becoming more and more crowded. They will never be less so than they are now. In a few months at least the difficulties attending the laying of pipes in the business streets will be vastly greater than they are at present. Moreover, the winter is coming on, when it will be almost impossible to carry on the work. At present, under the favorable circumstances of the season and weather, it will be a much simpler matter to lay the pipes. The inconvenience to citizens will be reduced to a minimum if the work is done in the summer or early in the fall. Next year it will be far more annoying to the city to have the streets torn up; and, to be plain, we may meet greater opposition next year than we are meeting now.' Corporation Counsel Miller was reluctant to express his views before they are formally committed to paper, but in his written opinion he will advise the Commissioner to refuse to grant the permit asked—namely, for the right to lay pipes at one time in Madison, Dearborn, Clark, and State streets, and Wabash avenue. He will advise the Commissioner that he has a right to insist that the Economic Company ask for permits to lay pipes in the streets and alleys lying in the neighborhood of and running from the central point of its system—the producing plant—and that he has the right to refuse to allow it to tear up the down-town streets before it has applied for permits in the district adjacent to the central or initial point. The question of the right of the Company to tear up the streets, and considerations of the desirability or undesirability of the ordinance, as well as all queries relative to the intentions and good faith of the projectors of the Company, were for the Council to decide. With them the Commissioner of Public Works can have no intimate concern, so far as the question in point is involved. It is for him to see that the provisions of the ordinance are stringently adhered to. Within the lines of the ordinance the Commissioner has much discretionary power."

THE electric lighting plant at Colfax, Oregon, was completely destroyed by fire about a fortnight ago. The loss is placed at about $8,000, partly covered by insurance. The proprietors say they will rebuild at once, but owing to the difficulty of securing the necessary machinery the town is likely to remain without light for some weeks.

"OBSERVER," under date of the 10th inst., forwards the following: "No Massachusetts city or town has taken any decisive step as yet in regard to municipal lighting. North Attleboro, Melrose, Peabody, Marblehead, Spencer, Reading, Hingham, Braintree, and perhaps one or two other places, have appointed committees to investigate the subject, but none of them have made their reports. These, when sent in, will be awaited with interest, not only in this State but all over the country, as Massachusetts was the first State to pass a general municipal lighting act. The committees that have studied the subject are less enthusiastic over town and city lighting plants than when they first started. The bill as passed is not what its introducers wanted. They demanded a bill which would give corporations but few opportunities to protect themselves; however, the law as passed is really a compromise. It provides safeguards for the proprietors of corporations now engaged in the business of supplying light, and does little more than recognize the principal involved in municipal lighting supply. The probability of towns putting in their own plants is far greater than in the case of cities. In fact large cities would find it a very difficult undertaking to establish municipal plants. The dissatified framers of the first bill introduced in the Legislature will endeavor to have another bill passed next year, which will strike out that section providing that cities or towns intending putting in a municipal plant shall first offer to purchase the plant doing lighting in its district at a fair market price. This, if granted, would give towns and cities an opportunity to terrorize over local illuminating corporations and would deal unfairly with those who have capital invested in the enterprises. A fair sample of this injustice is shown at Hamilton, O., where the town has built a works and is supplying gas to private consumers in competition with the local company, that for years had the field to itself. All the towns in Massachusetts that have so far appointed investigating committees seem to be desirous of putting in electric lighting plants only, evidently in the belief that altogether too much is charged for electric illumination. As a plain matter of fact the gas companies of Massachusetts are far better dividend earning and paying properties than electric companies. Providing any town should undertake to run its own electric light and gas plant, it will in a short time discover that there are a great many technicalities in the business which can best be taken care of by private corporations. This is perhaps more applicable to electric lighting plants than to gas works. The operation of a gas plant is conducted on well established lines, but central station electric light companies are experimenting all the time on their generating and supply systems. The management of these latter plants even now is not what it should be, as shown by the expense returns of many companies. What is apparently an economical running of an electric light plant is often most expensive. Good outside construction is absolutely necessary and a technical as well a financial man is wanted to manage every station. This has been demonstrated a number of times in New England. Furthermore, a great many town authorities want town plants, which desire they can have passed upon at any time by appealing to the State Board of Gas and Electric Light Commissioners. This some of them are commencing to understand, which, together with the realization of what responsibility a gas and electric light plant entails, makes them more conservative than they were at first when municipal lighting was their only theme."

THE Portable Electric Light and Power Company has been organized at Denver. The projectors will follow the Wright system.

THE Ventura (Cal.) Asphaltum Rock Company's mines are about 10 miles from the seaboard. The product contains 25 per cent. of fixed bitumen. It softens at 200° F., and melts at from 480° to 500° F. It carries a trifling percentage of lime.

THE Canada Gas and Fuel Company, with headquarters at Chicago, has been incorporated by Messrs. Thurston G. Hall and Lofus E. Dancey, of Chicago, and T. N. Dancey, Patrick Dowling, Philip Holt, M. C. Cameron and Richard Cartwright, of Canada. It is capitalized in $5,000,000, and the purpose is to exploit the "Hall electric gas process" in the United States and Canada. Rumor has it that the especial point of attack is Toronto, Canada, which rumor must bring smiles to the faces of Mr. Pearson and his associates, who, with their splendidly equipped gas works and their low selling rates can easily hold the field against any and all opposition.

THE end in the gas war at Elizabeth, N. J., would seem to be at hand, with the Messrs. Kean of the old Company well to the front.

A BRANCH of the New York Gas Appliance Exchange has been opened at No. 83 Flatbush avenue, Brooklyn, N. Y.

UNDER Mr. W. A. Armington's judicious management the Flatbush (L. I.) Gas Company is making rapid strides. Indeed, if we do not make a very great mistake, he will soon have to call upon the founders for more pipe for main extensions.

The Market for Gas Securieties.

The city market for gas shares during the week was absolutely lifeless, and the quotations made were in fact of no merit whatever as indicating the value of the shares. Consolidated sold at 93¾ to 94, but was immediately marked down to 92½-93, at which nominal rating it was reported at the opening to day—Friday. Mutual and Equitable are quoted at 118 to 121, and both are dull and strong. Standard common was inquired after, but we have no record of any actual sales, holders asking 47 to 48, while bidders did not seem disposed to offer over 43.

Over in Brooklyn the situation remains unchanged, save that perhaps a greater feeling of security obtains. In fact, some of the Brooklyn magnates are inclining to the view that $1.25 gas might not be such a bad thing for them after all. It seems to us that Fulton-Municipal, at, say, 118, would not be a bad purchase, and the same opinion would apply to old Brooklyn. To be sure, the Equity Company stands as a disturbing factor, but it is likely the owners of the Company will not be unreasonable when the time comes for consolidation, a termination that must come sooner or later. In out-of-town shares there has not been much change, unless we except Chicago gas, which is enjoying its usual ups and downs. The least said about the situation there the better; but those who can afford to buy it at or below 50 and put it away in their strong boxes cannot fail to do well, even if they do have to wait a year or two for permanent results. There is nothing of interest in the general situation,

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

August 17.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	92½	93
Central	500,000	50	--	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	118	120
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	118	121
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co--				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	95	98
Citizens	1,200,000	20	78	80
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	115	120
" Bonds	300,000		100	105
Peoples	1,000,000	10	70	73
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	90	95
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	131	—
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	110	112
" Bonds	1,000,000	—	105	109
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	87	—
2d " " "	3,000,000	1000	—	74
Bay State Gas Co.—				
Stock	5,000,000	50	48	50
Income Bonds	2,000,000	1000	98	102
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Company.	25,000,000	100	45⅞	45½
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	90	91½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	—	100½
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	6,500,000	100	207	209
Consumers Toronto	1,000,000	50	169	172
Central, S. F., Cal.			90	—
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	42½	43
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	109	114
Jersey City	750,000	20	165	170
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	13	13⅛
Preferred "	2,500,000	100	30	50
Bonds	9,034,400	1000	72½	73¼
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			34¾	35¼
Peoples, Jersey City		—	115	125
" " Bonds.			—	—
Paterson, N. J		25	99	102
Rochester, N. Y		50	99	100

WANTED,

A Man who Thoroughly Understands Making Sulphate, or Salts of Ammonia.

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845-4 Peoria, Ill.

POSITION DESIRED

As Superintendent of Gas Works,

By a man fully competent to take entire charge of construction, manufacture and distribution of either coal or water gas. Best of references. Address "WESTERNER,"
844-tf Care this Journal.

Engagement Desired

As Superintendent or Assistant Superintendent of a Coal Gas Works.

By a young man having 12 years' experience as Foreman. Best of references. Address FOREMAN,
844-4 Care this Journal.

Position Wanted

As Superintendent of Combined Gas and Electric Works,

By a young man with practical experience in details of construction, manufacture and distribution of gas and electricity. Combined plant preferred. Best of references. Will be open for engagement Aug. 1. Address
841-5 "H. H. W.," care this Journal.

POSITION WANTED

As Superintendent,

By a man of experience in the manufacture and distribution of gas. Has had charge of gas and electric light plant sending out 15,000,000 cu. ft. of coal gas annually. Has been Superintendent of present plant 14 years, doing all main and service pipe work, setting meters, taking statements, making lead connections, selling and setting gas stoves, etc. Address
842-4 "SUPERINTENDENT," care this Journal.

SUPERINTENDENT WANTED,

By Gas Company who also operate an Electric Light Plant. Must be thoroughly competent in all matters pertaining to the construction and operation of the gas works, and also understand steam and have had experience in running electric lights. Must give good references and be a worker. Address, with full particulars concerning themselves and references, also stating salary expected, TREASURER GAS AND ELECTRIC CO.,
842-tf Care this Journal.

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VOLTMETERS AND AMMETERS.

These Instruments are the most accurate, reliable, and sensitive portable instruments ever offered. A large variety of ranges, to meet the requirements of all kinds of work.

Send for Catalogue.

Weston Electrical Instrument Co.,

Office & Factory, 114-116 William St, Newark, N. J.

Gas Stock for Sale.

$10,000 to $12,000 of the Stock of a Gas and Electric Light Company.

To someone competent to assume the management of the business, and who is familiar with both gas and electric work.

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It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

Correspondence Solicited with all who require a Reliable Governor.

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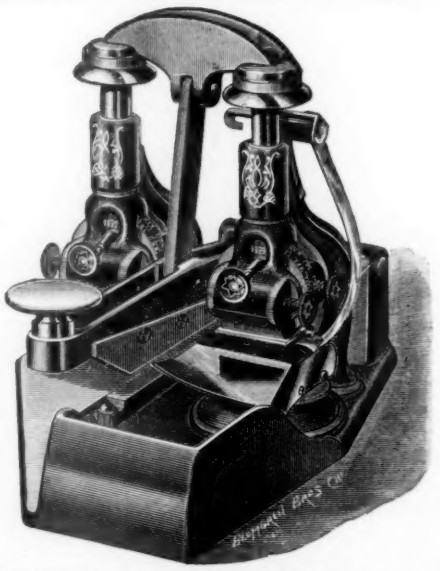

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MR. HORACE W. BECK, Sec. Fort Worth Light and Power Co., says: "The machine works splendidly; we are charmed with it, and can do the work with it in one-half the time."

MR. J. D. THOMPSON, Vice-Prest. Laclede Gas Light Co., St. Louis, says: "We can handle three or four persons where only one could be attended to before."

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BRONZED JACKETED, EXTRA FINE FINISH, ALL THOROUGHLY FIRST-CLASS.

Pillar and tip in one piece; slot cut smooth, and emitting handsome, broad flame, with highest candle power. Sizes from 2 to 8 feet, under 4-10ths pressure. All marked.

These goods will be sold in 50 gross lots, at $1 per gross, spot cash.

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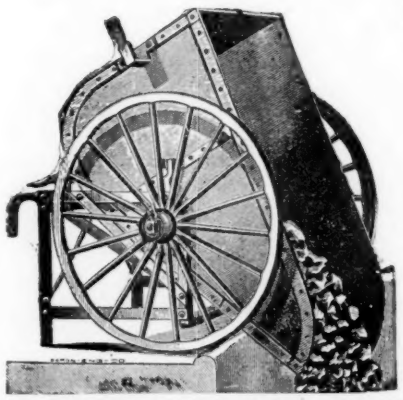

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A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the Tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, six years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. Several have been erected in the United States.

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers.

"C. A. GERDENIER, Supt. Bridgeport (Conn.) Gas Lt. Co."

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results guaranteed in every instance.

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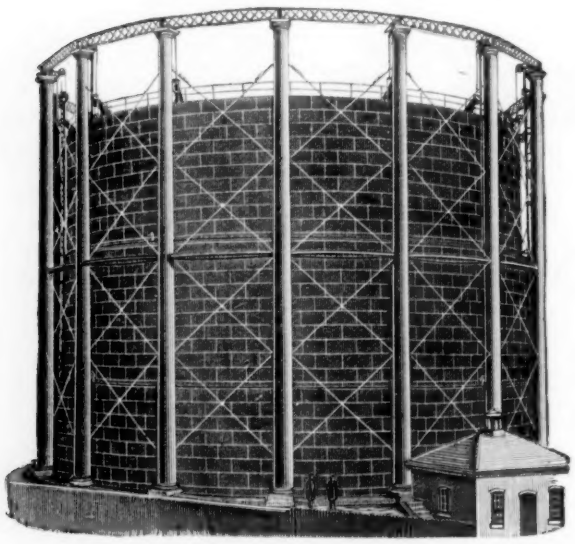

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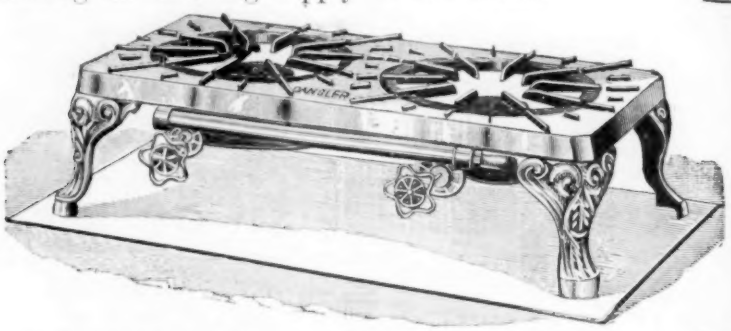

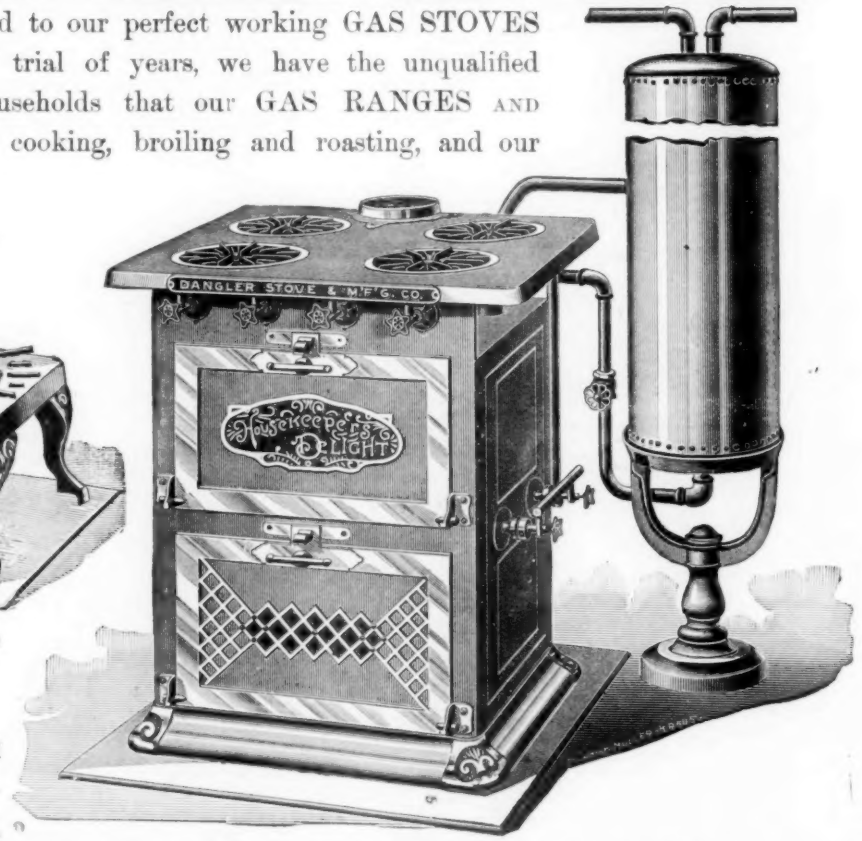

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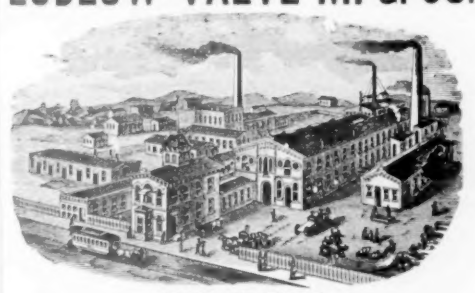

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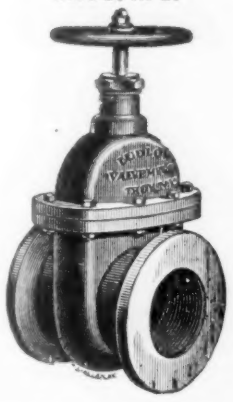

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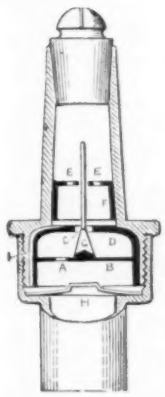

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Free Sample and Special Price to Gas Light Companies.

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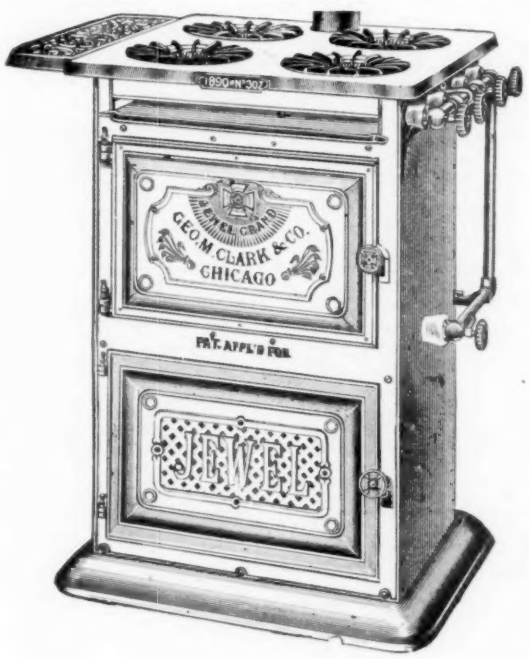

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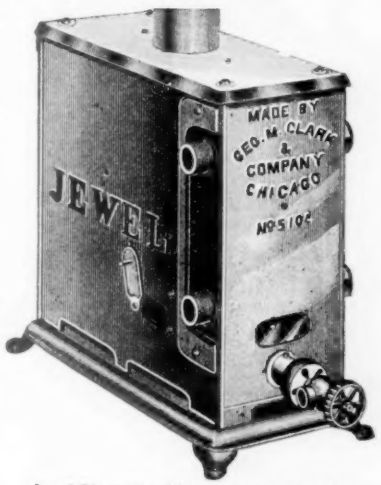

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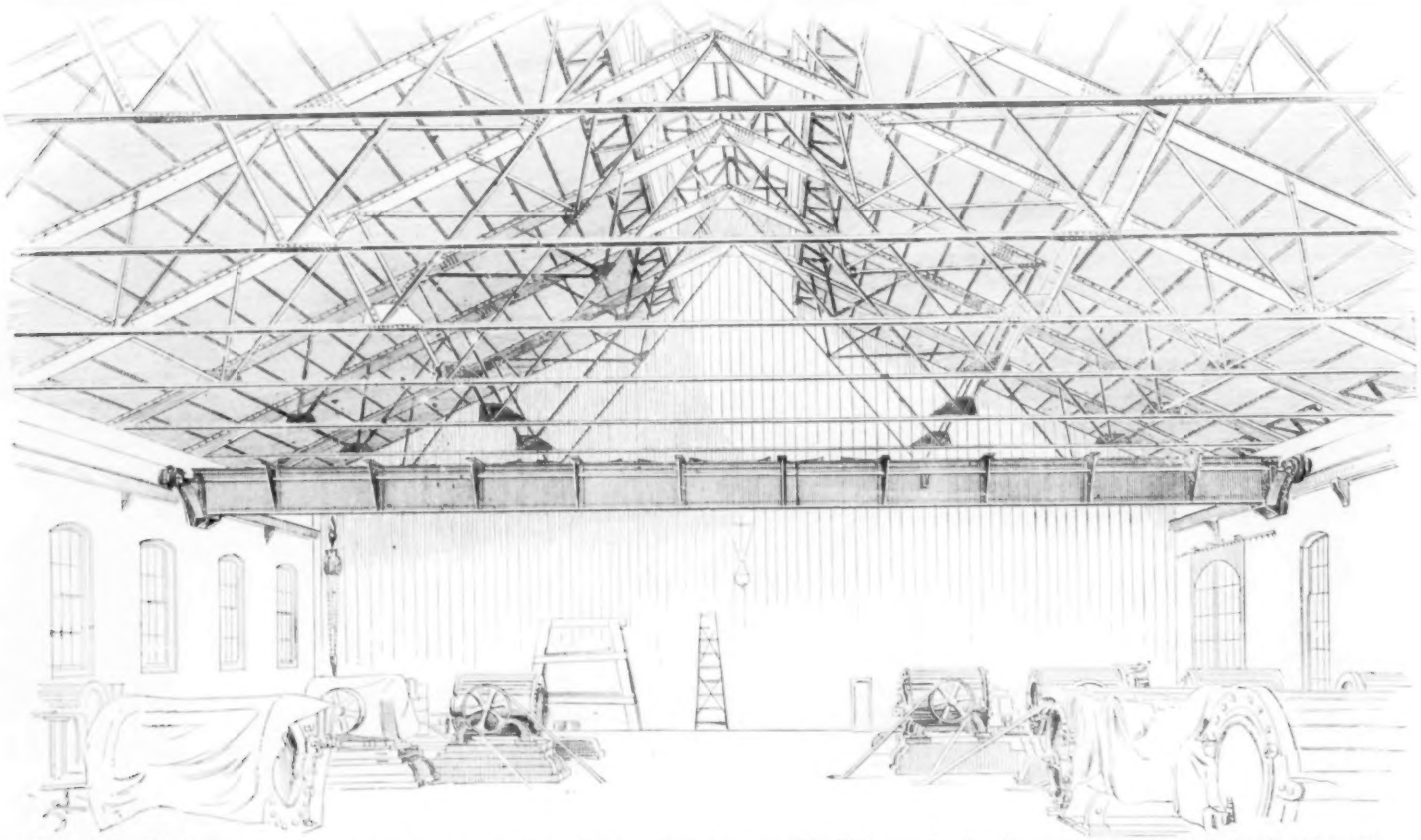

The above illustration is taken direct from a photograph of an iron truss roof built by us for the Narragansett Electric Light Company, a Providence, R. I. The roof is built entirely of iron, not a particle of woodwork being used about the construction of the building in any way, so that the danger from fire is entirely eliminated. The traveling crane shown in the illustration was also furnished by us, and is used to move the dynamos about the room. To Electric Light Companies who want a building which is indestructible by fire the above commends itself. *Write for Illustrated Catalogue.*

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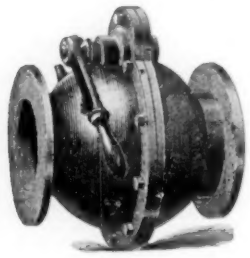

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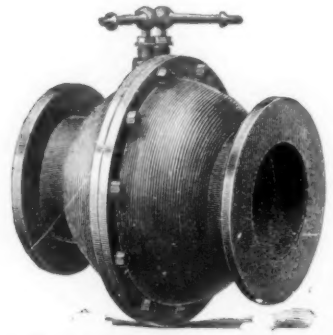

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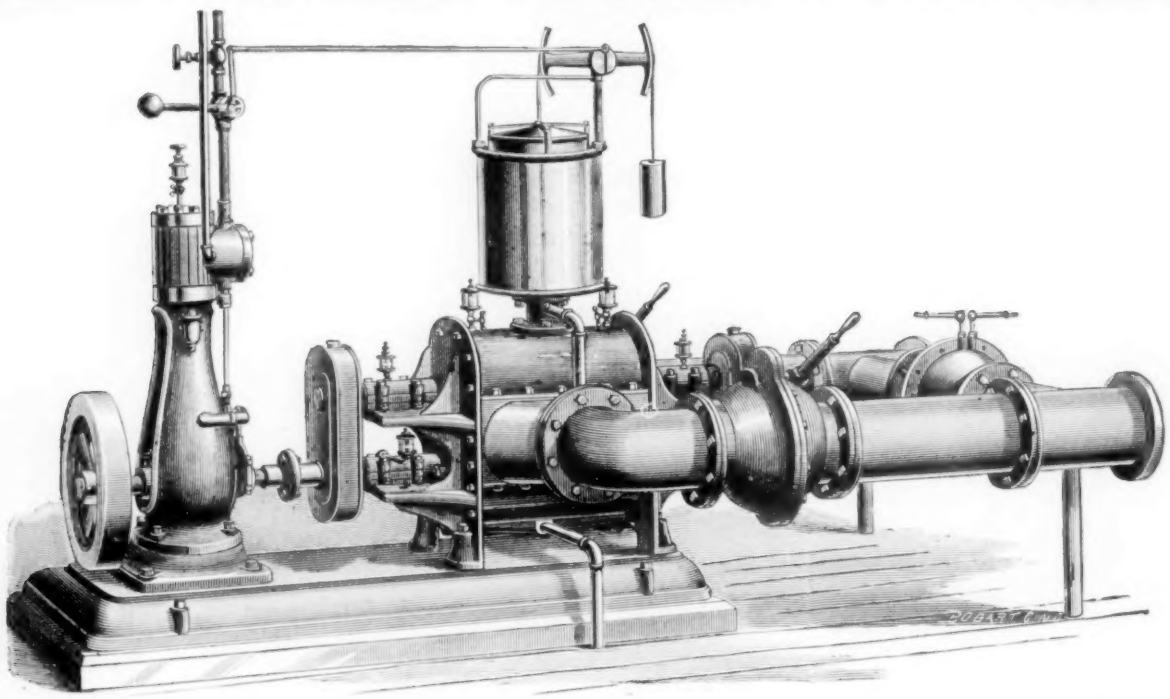

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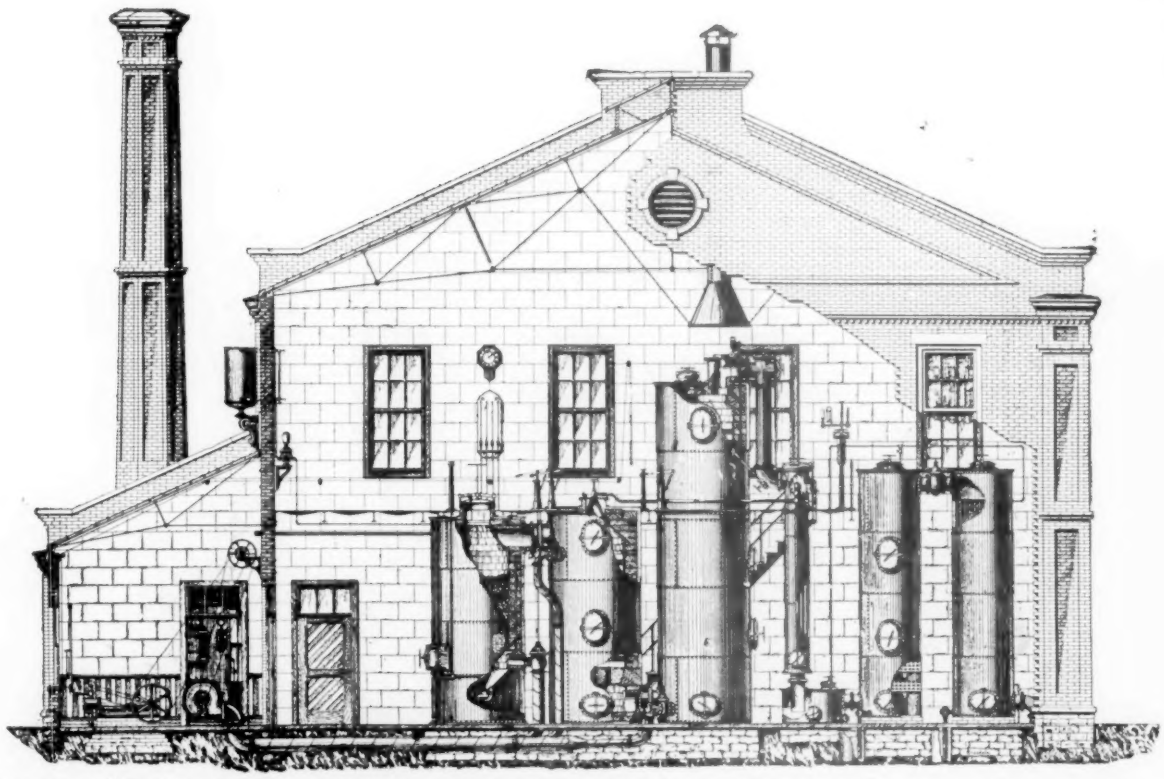

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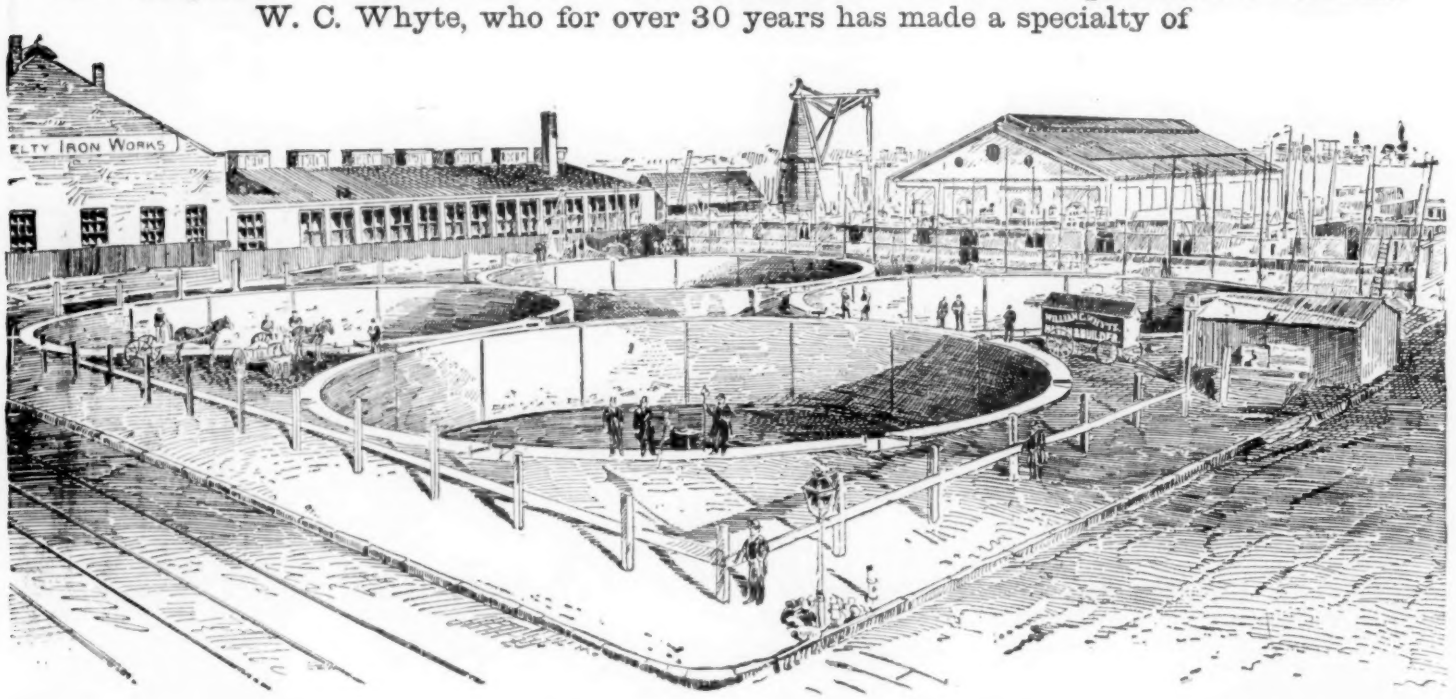

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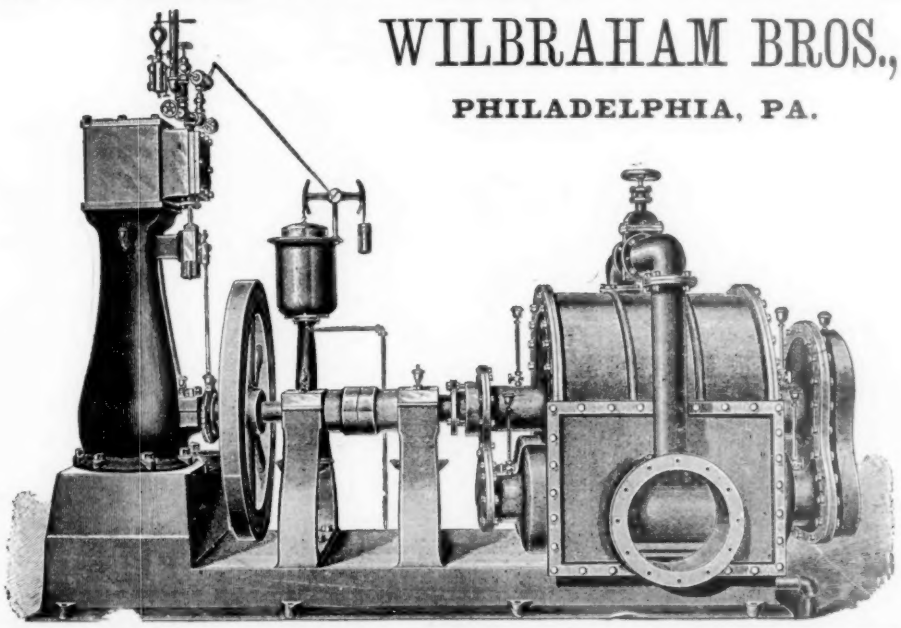

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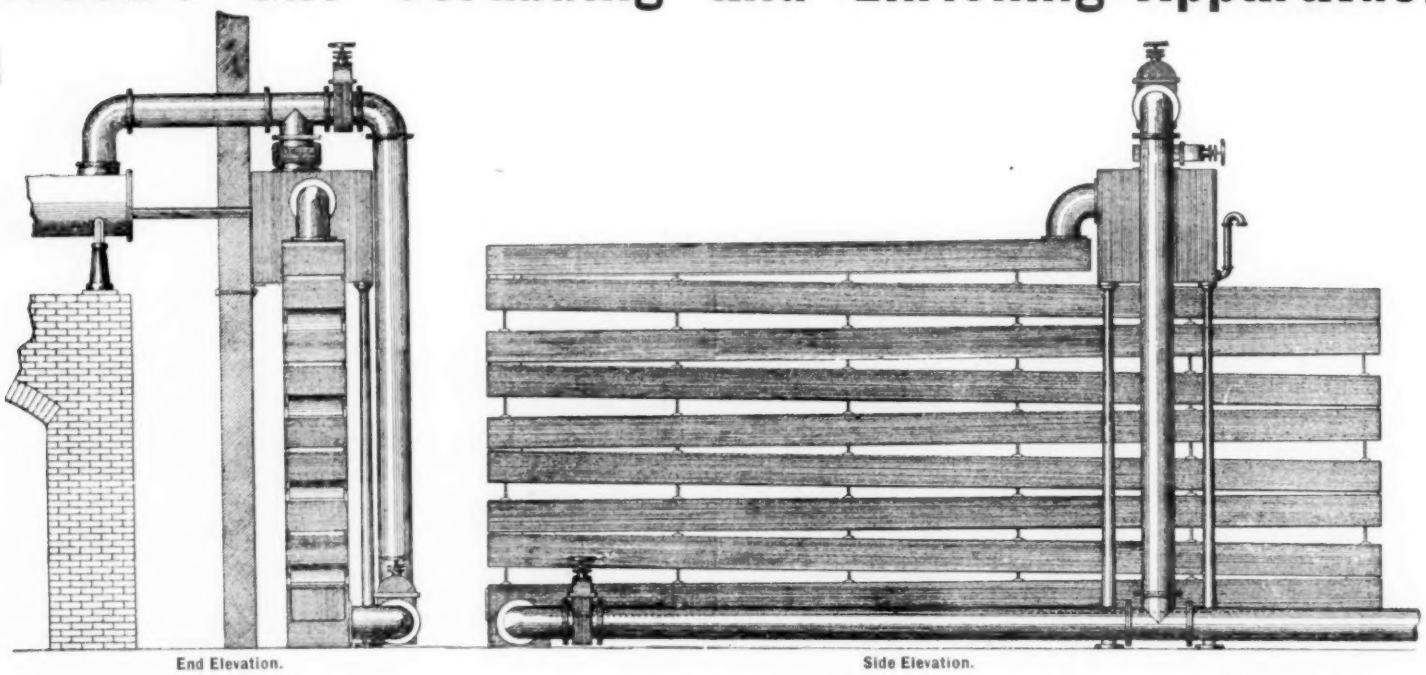

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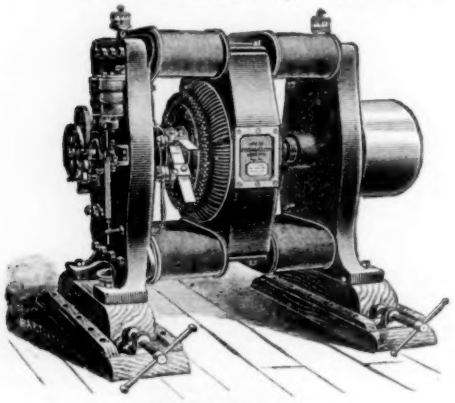

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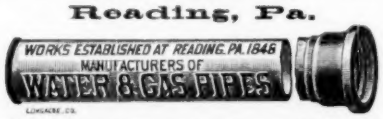

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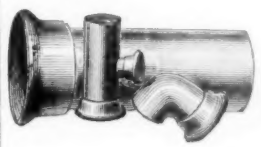

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Chicago, Milwaukee & St. Paul Railroad Co	5	100
Chicago, Rock Island & Pacific Railroad Co	4	170
Colorado Midland Railway Co	1	25
Denver & Rio Grande Western Railroad Co	3	75
East Tennessee, Virginia & Georgia Railroad Co	3	325
George's Creek & Cumberland Railroad Co	2	50
Grand Trunk Railway Co. of Canada	12	500
Gulf, Colorado & Santa Fe Railway Co	3	135
Kansas City, Wyandotte & Northwestern Railway Co	2	55
Newport News & Mississippi Valley Co	2	200
New York Central & Hudson River Railroad Co	4	125
New York, Lake Erie & Western Railroad Co	2	140
New York, West Shore & Buffalo Railroad Co	6	340
Northern Pacific Railroad Co	2	45
Pennsylvania & Northwestern Railroad Co	1	25
Pennsylvania Railroad Co	51	2330
Peoria & Pekin Union Railroad Co	1	55
Philadelphia & Reading Railroad Co	7	615
Pittsburgh, Cincinnati, Chicago & St. Louis Railway Co	3	20
St. Louis & San Francisco Railway Co	3	260
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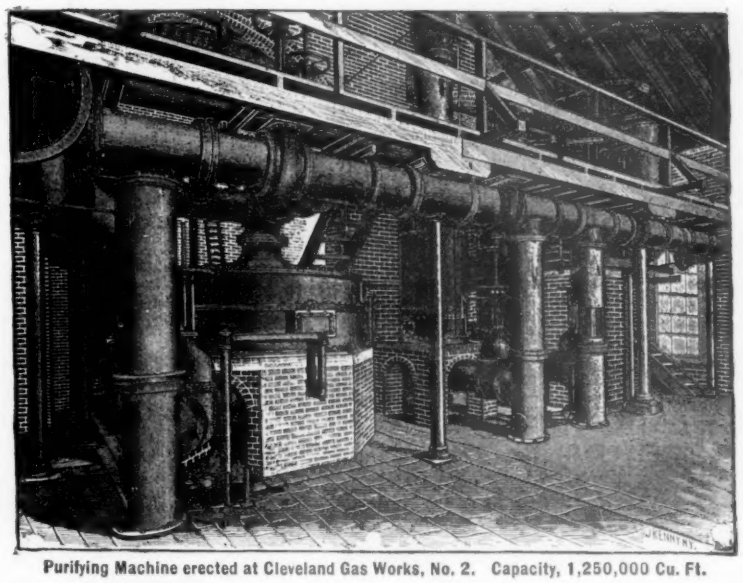

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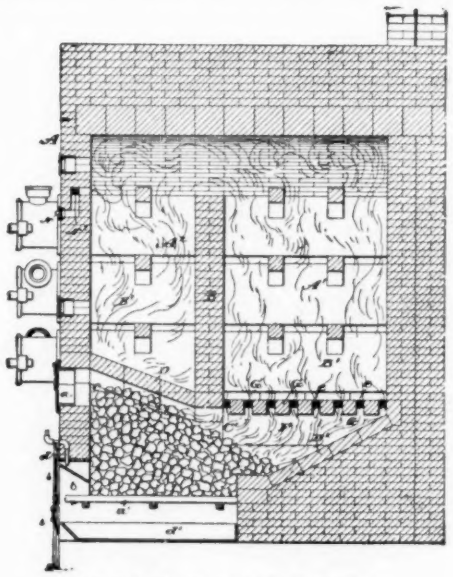

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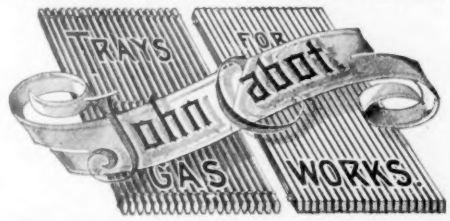

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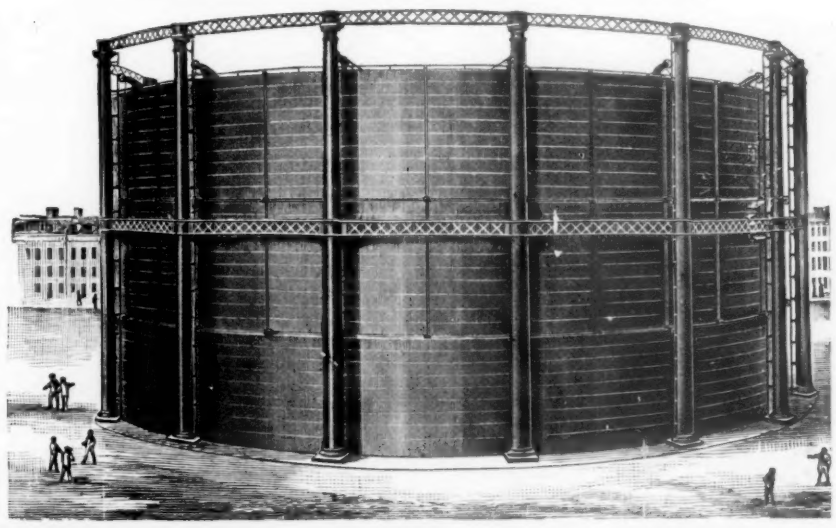

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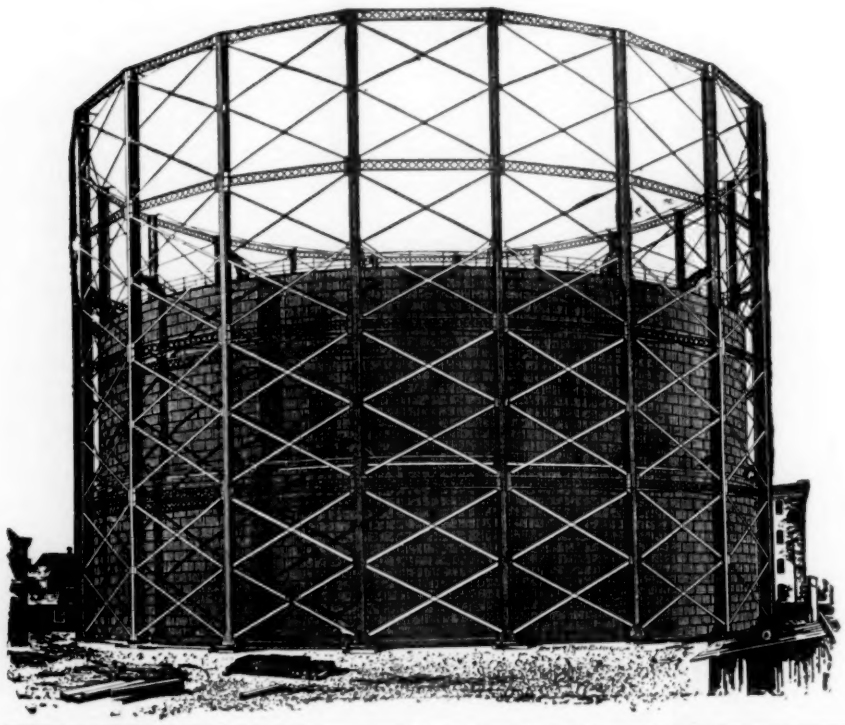

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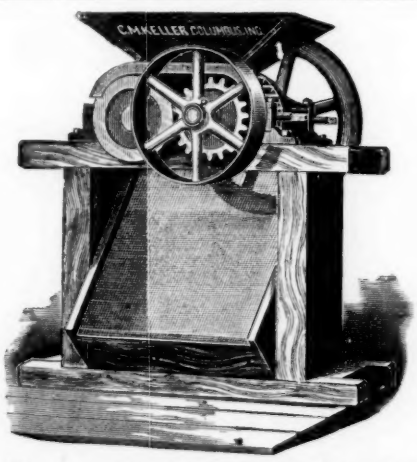

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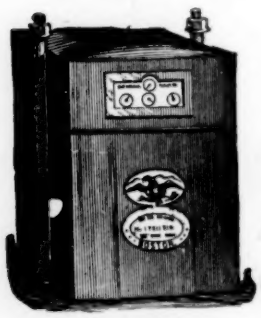

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The Most Economical, Efficient, and Durable Gas Stove Made.

SIZE.

Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9¾ inches high.	10 inches high.	21 inches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12⅝ inches deep.	12½ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1½ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1½ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

Catalogue showing Styles and Prices sent free on application.

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Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

METER PROVERS (Sizes 2, 5 and 10 feet.)

Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

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